The Physiotherapy Review

Volume 21 Number 1

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Muscle Group Testing

Signe Brunnstrom, M.A.

The importance of accurately measuring muscle strength in the aftercare of infantile paralysis is obvious. To perform an extensive and time consuming muscle test at the beginning of the treatment and at regular intervals afterwards is just so much waste of time unless the test possesses a reasonable amount of accuracy. The purpose of this paper is to give a critical evaluation of the muscle test most commonly used today, pointing out its shortcomings and discussing ways and means of improving it.

Dr. Robert Lovett of Boston and his assistant, Miss Wilhelmina Wright, tried out various methods of testing and recording muscular strength[1]. At first the charts developed by Dr. E. A. Sharpe of Buffalo were used. These charts consisted of drawings of anterior and posterior views of the body with an outline of the most important muscles. The wholly paralyzed muscles were closely shaded, the partially paralyzed muscles were shaded with coarse lines and the normal muscles were not shaded at all. The charts were practical because one glance at the chart would give an approximate idea of the extent of paralysis present. However, "partially paralyzed muscles" would include all muscles which were partially affected, whether the affection were slight or severe. It soon was found that a more detailed record of the affected muscles was necessary.

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The "Spring Balance Muscle Test," worked out by E. G. Martin of the Physiological Department of the Harvard Medical School in cooperation with Lovett and described in various books and articles[1, 2, 3] was a definite improvement on the previous test. By means of this test, gain and loss in muscular strength could be measured in pounds. It proved to be a very reliable test for strong and fairly strong muscle groups. However, extremely weak muscles could not be tested accurately.

The grading system which was finally found most satisfactory by Lovett, and which was soon widely accepted by physicians and technicians, judges the strength of muscles mainly in relation to gravity. Lovett states that "the method of examination described is not a mathematically accurate one, but it has the advantage of requiring no apparatus and of providing a graded series of tests for estimating muscular power.

Editor's Note

Of necessity some material has been deleted from the article on "Muscle Group Testing" by Signe Brunnstrom, "Gaits" by Alice Lou Plastridge and "Testing of the Muscles of the Abdomen" by Florence P. Kendall, all of which were presented at the Annual Convention of the American Physiotherapy Association in New York City, June 1940. Since a considerable amount of this material was presented by means of slides and demonstrations, it was impossible to include all the personal comments, problems and criticisms which were brought up during the informal discussions.

The papers on the "Study of the End Results of the Conservative Treatment for the Paralytic Stage of Poliomyelitis" by Raymond Lenhard, M. D., "Testing of the Muscles of the Abdomen and Back" by Alice Lou Plastridge, and "Testing of the Muscles of the Lower Extremity" by Marjorie Dennen have been omitted from this publication of the "Round Table on Muscle Studies."

"The muscles were graded as:

1. Normal.

2. Good, when the muscle was strong enough to overcome gravity and some resistance but was not quite of normal strength.

3. Fair, when the muscle was able to overcome gravity and could perform part of the normal movement.

4. Poor, when slight movement could be accomplished but gravity could not be overcome.

5. Trace, when no movement of the limb could be accomplished but the muscle could be felt to contract.

6. Totally paralyzed, when attempted voluntary movement was not accompanied by any perceptible contraction of the muscle."[1, 4]

This method, or a modification of it, is commonly used in hospitals and clinics today. To these original grades most examiners add pluses and minuses in order to make finer differentiations. Each technician, or each hospital, has a somewhat different interpretation of the grades. The range of motion which can be performed, the number of times a movement can be repeated without causing fatigue or the amount of manual resistance given by the examiner determine the grade. Kendall[5] lists fourteen grades, beginning with "zero" and ending with "normal plus," and also suggests recording muscle strength in percentage to correspond with the above grades. Lowman[6] lists ten different grades, using numerals from 0 to 9. There is no uniformity in testing methods or in terms used. For instance, "fair plus" is described by Lowman as "beginning action of joints but not against gravity or enough to overcome friction of table." Kendall, on the other hand, states that a "fair plus" muscle "completes the arc of motion against gravity and a minimum amount of resistance." What terms are used may not be important in themselves, as long as all individuals in the same institution know their meanings, but it is very confusing to students and to all persons who consult the literature. Standardization of terms, therefore, is highly desirable.

The most commonly used muscle test chart consists of a list of muscles to be graded individually. On some charts parts of muscles are listed separately, as, for instance, the three parts of the trapezius and the various parts of the deltoid. Occasionally several muscles are put into one group and graded together; for example, the outward rotators of the thigh or the inner hamstrings. However, practically all charts are made up with the assumption that the strength of individual muscles can be measured.

Authorities in the field of tests and measurements agree on certain criteria to be kept in mind when evaluating a test. The most important ones mentioned by Bovard and Cozens[7] are: (1) validity, (2) reliability, (3) objectivity and (4) standardized directions. For a critical evaluation of our present method of testing muscles, each of these criteria may be chosen as a starting point for discussion.

Validity. "The first question we should ask about a test is: 'Does the test measure what it purports to measure, or what we wish to measure, or how well does it measure what it claims to measure?'"[7] If we claim to measure the strength of the biceps brachii, or the brachialis, or the gluteus minimus, or any other muscle separately, does our test really measure the strength of this one muscle? In other words, is there any one movement which is performed by the biceps alone, or by the brachialis alone, or by the gluteus minimus alone?

The biceps brachii is a flexor of the forearm and also a supinator. However, when we flex the forearm, there are other muscles which participate in the movement or which may participate: brachialis, brachioradialis, pronator teres and others. Likewise, when we supinate the forearm, the biceps is not the only muscle performing supination. When we abduct or inwardly rotate the thigh, the gluteus medius and the tensor fascia lata will come into action in addition to the gluteus minimus.

Since movements and not individual muscles are represented in the cerebral cortex[8], and since practically every movement, however simple, is the result of contraction of more than one muscle, it is almost impossible for the average person to innervate one muscle separately, let alone to contract one muscle to its fullest capacity, without bringing accessory muscles into play. Thus we find that when attempting to measure the strength of one muscle, we actually are measuring that muscle plus a number of other muscles or parts of muscles.

At this point it may be argued that a skilled examiner by carefully choosing testing positions and movements may be able to isolate muscle action to a considerable degree. It is true that in many movements there are ways and means of preventing one muscle from contracting while another is tested, even though the action of the two muscles be similar, but completely to rule out undesired muscle action is impossible. For instance, when testing the gluteus minimus, how can the gluteus medius be excluded? Or when judging the strength of the biceps brachii, in flexion of the forearm, how can one prevent the

brachialis from participating? When testing the strength of one of the hamstring muscles, how can one make the two others relax? Also, there must be activity in muscle groups, other than those actually performing the movement, in order to give fixation to parts, in order to guide the movement and so on. The efficiency of the motion tested depends somewhat upon the action of these auxiliary muscles.

We must come to the conclusion, therefore, that our individual muscle test is not valid because we do not really measure what we claim to measure.

Reliability. "The reliability of a test may be defined as 'the degree to which the measuring instrument gives a constant score for a constant degree of that which it measures.' In other words, the reliability of a test refers to the accuracy of the test itself, how accurately it measures whatever it may measure, not how accurately it measures what it is supposed to measure."[7] We are not concerned here with whether we measure one muscle or a group of muscles when a motion is performed, but we are concerned with how accurately we are measuring the strength of the motion itself.

The determination of the grades depends upon:

1. Whether or not a muscle or a muscle group can perform against gravity.
2. Whether or not the friction of the table and the friction of the joint can be overcome.
3. Number of times a motion can be performed without fatigue.
4. Range of motion.
5. Resistance by examiner.

In this test we are not using a measuring instrument giving an exact score, as, for instance, weight in pounds, height in inches or volume in cubic centimeters. The grades are determined by such highly subjective factors as manual resistance by the examiner and evaluation of onset of fatigue by the patient.

The factor of the action of gravity on a part also needs some consideration. Is this factor always constant? The action of gravity on a part depends upon the weight of the part and upon the angle of pull of gravity on the lever. Both these factors are variables. Obviously, a patient who puts on a great deal of weight or who loses weight between testing dates cannot be tested accurately. If there is more weight to carry, the muscles need to be stronger in order to perform a certain movement than if the weight is less.

In accordance with the law of leverage, in order to balance a lever, the weight multiplied by the weight arm should equal the effort multiplied by the effort arm, provided both effort and weight are acting at a right angle to the lever. When the effort or the weight is acting at an angle which is larger or smaller than a right angle, the effective component of the muscle pull or of the weight can be obtained by using the formula: effective component of effort = effort $\times$ sine a; effective component of weight = weight $\times$ sine β (a representing the angle of pull of the muscle, β the angle of pull of the weight). The smaller the angle of pull, the less the effective effort (or weight). When the angle reaches 90 degrees the whole effort (or weight) is utilized for motion.

For example, compare straight leg raising in the supine position to the same movement in the standing position. In the former case, gravity is acting at a right angle to the leg; in the latter case, along the long axis of the leg. When the first 5 degrees of flexion have been overcome, gravity is acting at an angle of 85 degrees in the supine position and at an angle of 5 degrees in the standing position. Obviously, the amount of muscle power required to overcome gravity is much greater in the supine position than in the standing position. After the movement has progressed beyond 45 degrees the reverse is true. Similarly, the effective component of the hip flexors is smaller at the beginning of hip flexion, at which time the angle of pull is very small, than after a few degrees of flexion.

The length of the lever is another factor to be kept in mind. Abduction of the arm in the standing position, for instance, is much easier to perform when the elbow is flexed than when it is extended. In the latter case the lever of the weight is longer and more muscle power is required to lift the arm.

The fact that a movement can be performed against gravity, therefore, is not an accurate measure unless the weight of the part to be moved is constant, unless exactly the same position is assumed each time a test is given and unless the movement is performed in a standardized way.

From this discussion we conclude that the reliability of the commonly used muscle test is very low. By standardizing testing positions and movements, however, a somewhat higher degree of reliability may be obtained.

Objectivity. "By objectivity is meant the degree of uniformity with which various persons may score the same test."[7] In the light of this definition, is our muscle test objective?

It has already been pointed out above that individual muscles cannot be completely isolated in

their action. The examiner, therefore, if grading individual muscles must use subjective judgment to determine how much power is supplied by one muscle and how much by another for a given motion. It is not to be expected that various persons will get the same result. If, on the other hand, muscle groups are graded instead of individual muscles, and if careful directions are given for each movement, a certain amount of objectivity is obtained. For instance, it can be determined objectively whether or not the flexors of the forearm are able to perform against gravity and whether or not the full range of motion can be executed. Those grades which are determined by the patient's feeling of fatigue or by the amount of resistance given by the examiner obviously still maintain their subjective character.

Standardized Directions. In order to be able to compare tests given on different dates or given by different persons the test must be carried out exactly the same way each time. Written directions should be available and exactly the same procedure should be followed by each examiner. The grades must be clearly defined and definitions universally accepted. As little as possible should be left to the imagination of the examiner. What seems self evident to one person may not be clear to another, and so on. A testing position for each movement and for each grade must be agreed upon. For instance, when the extensors of the knee are tested against gravity, it must be stated whether the thigh is in a horizontal or in a vertical position, or in a plane midway between the horizontal and the vertical, and whether the hip joint is flexed or extended (Figs. 1 A-E). If the patient assumes the position shown in Figs. 1A and 1B, the extensors of the knee have to overcome not only the weight of the lower leg but in most persons also a considerable amount of tension in the hamstrings. Such tension is eliminated in the positions shown in Figs. 1C, 1D and 1E.

In Figs. 1A and 1E, when the leg approaches the horizontal, gravity acts at a right angle to the leg and resists the movement with all its force. In Figs. 1C and 1D, on the other hand, the effective component of gravity is less. The amount of muscle power needed for knee-extension, therefore, is much less in the two latter than in the two former positions. Fig. 2 shows the exact amount of muscle power needed to keep the knee in extension when the thigh is horizontal and when the thigh is held at a 60 degree angle to the vertical plane. It is assumed that the quadriceps pulls at an angle of 30 degrees on the tibia,

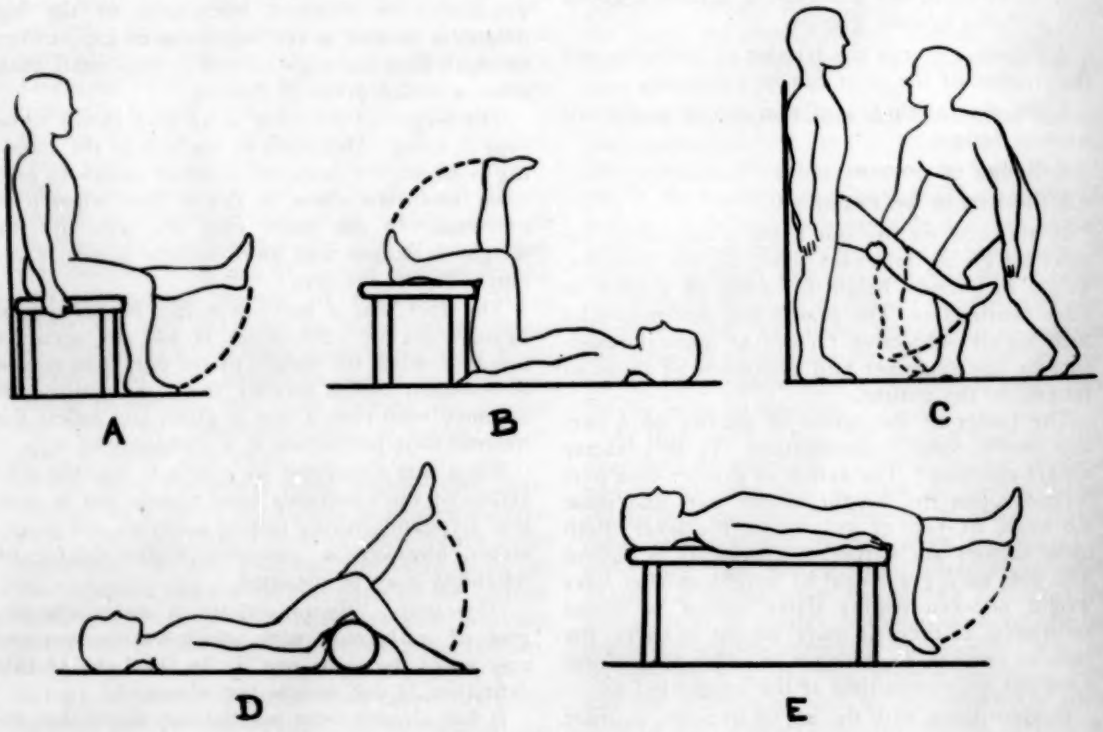

Fig. 1

that the distance between the fulcrum and the center of gravity of the lower leg and between the fulcrum and the insertion of the patellar tendon is 8 inches and 2 inches respectively, and that the weight of the lower leg is five pounds. With the thigh horizontal a contractile force of 40 pounds is required; with the thight at an angle of 60 degrees to the vertical only 34.64 pounds is needed. Table I gives the figures for angles from 20 to 90 degrees. Exactly twice as much strength is needed to keep the knee extended when the thigh is horizontal as when it forms an angle of 30 degrees to the vertical plane.

TABLE I

Angle of thigh to vertical plane Degrees	Pounds
20	13.68
30	20.00
40	25.71
50	30.64
60	34.64
70	37.59
80	39.39
90	40.00

Reference already has been made to the tension in antagonistic muscles. Special care must be taken to eliminate tension in two joint muscles. When testing the quadriceps, only slight flexion at the hip joint should be allowed so as to avoid tension of the hamstrings; dorsal flexion of the foot should be performed with the knee joint flexed to eliminate the tension of the gastrocnemius; flexion of the fingers should be tested with the wrist dorsal flexed; extension of the fingers with palmar flexion of the wrist, and so on.

To overcome some of the shortcomings of our present system of testing, the following suggestions are made:

1. Since the action of individual muscles cannot be isolated accurately, muscle groups should be graded instead of individual muscles. Whenever necessary, the strength of individual muscles should be estimated, but it should be stressed that such grading is highly subjective.

2. Terms for grading should be standardized and clear definitions given.

3. Testing positions as well as directions for movements should be standardized and available in printed form.

In this manner the test would gain in validity, reliability and objectivity.

Whenever an estimate of individual muscle power is necessary, subjective judgment must be relied upon. Such an estimate, when given by a skilled examiner, is not worthless but will give very valuable information. Testing individual muscles is a highly specialized field. Anatomical knowledge alone is not sufficient; great skill and much experience also are required.

When evaluating the strength of individual muscles, palpation of the muscle together with observations of various movements with and without resistance must be relied upon. Movements must be chosen which will eliminate, to the greatest possible extent, the action of adjacent or synergistic muscles. Antagonistic muscles likewise must be relaxed. It is not the purpose of this paper to discuss methods of bringing out individual muscle action. This is a most fascinating subject in itself and will be dealt with in a separate paper. To illustrate the point, only one example will be given.

The subscapularis muscle internally rotates the arm. Other muscles having inward rotatory power include pectoralis major, latissimus dorsi, teres major and anterior deltoid. When evaluating the strength of the subscapularis muscle, the action of the other inward rotators, so far as possible, must be eliminated; a position must be found which permits the palpation of the sub-

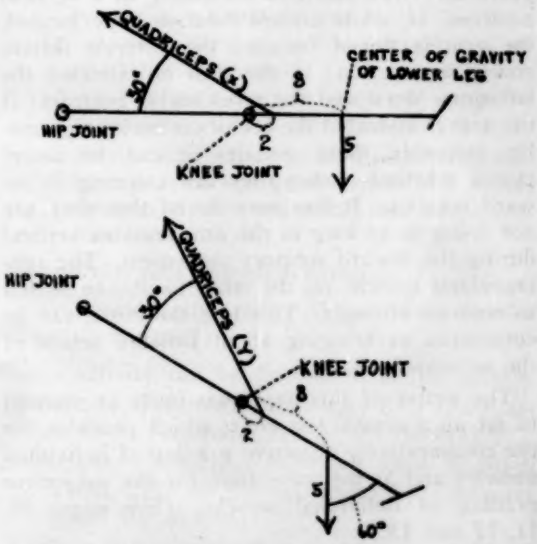

Fig. 2 By applying the law of leverage the following equations are obtained:

$$X \times \sin 30^\circ \times 2 = 5 \times 8;\ X = \frac{5 \times 8}{0.5 \times 2} = 40$$

$$Y \times \sin 30 \times 2 = 5 \times \sin 60^\circ \times 8;$$

$$Y = \frac{5 \times 0.866 \times 8}{0.5 \times 2} = 34.64$$

scapularis. Finally, if both arms are involved, making comparison with the other side impossible, the examiner must have a good appreciation of the usual size and bulk of the subscapularis muscle in persons of various age, sex and stature. The following procedure is suggested:

Patient lies prone on the table with the arm hanging relaxed over the edge or stands with the trunk inclined forward and the arm hanging loose. "Have the feeling that your arm is very heavy as if a weight were attached to your elbow." This, or similar instructions, will help the patient to relax the muscles around the shoulder girdle, allowing the weight of the arm to pull the scapula forward on the rib cage. If the patient is able to let go, there will be enough space between the scapula and the rib cage to allow the examiner to palpate the bulk of the subscapularis muscle. The fingers of the examiner should be inserted anteriorly to the latissimus dorsi muscle, and care must be taken not to press on the nerve trunks in the axilla. If the above precautions are taken, the patient does not mind the examination, and the deeply situated subscapularis muscle can be palpated without difficulty. To eliminate the action of the other inward rotators it must be insisted upon that a pure inward rotation is performed with the arm remaining in a vertical position. If, while inward rotation is performed, the arm is flexed forward the anterior deltoid comes into action; if the arm is extended the latissimus dorsi and the teres major contract; if the arm is adducted the pectoralis major tightens. By palpating these muscles it can be ascertained whether or not they are assisting in inward rotation. It has been found that they are not doing so as long as the arm remains vertical during the inward rotatory movement. The subscapularis muscle, on the other hand, can be felt to contract strongly. This test, therefore, can be considered as bringing about isolated action of the subscapularis.

The writer of this paper has made an attempt to set up a muscle test chart which provides for the comparatively objective grading of individual muscles and at the same time for the subjective grading of individual muscles. (See pages 10, 11, 12 and 13.)

These charts have been used at the Institute for the Crippled and Disabled for more than a year and have been fairly satisfactory. From the Institute's point of view it is more important to know whether or not a certain movement can be performed than it is to know which muscles are acting. However, since the charts were intended for teaching purposes as well, individual muscles are listed under each movement. It is felt that these charts have a practical value inasmuch as a student can learn to grade movements in a short time. The detailed knowledge of muscle action and skill in testing individual muscles is acquired gradually while the chart is being used.

Grades for movements are recorded in the margin on the left and on the right side. Space is provided for the grading of individual muscles, if this is desired. There are four charts altogether: two for the upper extremity, one for the lower extremity and one for the back and the abdomen. Many muscles are listed which cannot be graded individually. This is particularly true about the fourth chart. These muscles were included for teaching purposes and no attempt is made to test all of them separately.

The suggestion is made that a committee of technicians, specializing in muscle testing, work out a muscle chart along the lines discussed in this paper. Testing positions and testing movements should be standardized and the definitions of grades should be agreed upon. These charts, together with instructions on how to use them, could then be published with the approval of the American Physiotherapy Association and their use promoted all over the United States.

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MUSCLE TESTING IN POLIOMYELITIS

Suggestions for Standardized Procedure

There are very few muscles in the body which can be contracted individually. Because of the action of other muscles producing movements, it is difficult to grade the strength of separate muscles. From the functional standpoint it is more important to grade the strength of movements

than of individual muscles. The grading of movements can be made more objectively than the grading of individual muscles and requires less skill on the part of the technician.

The approximate strength of separate muscles, however, must be known to the orthopedic surgeon and those who carry out the muscle reeducation program. Records of separate muscles will necessarily be of a more subjective character, since objective tests for isolated muscles have not as yet been devised. For the grading of individual muscles the technician has to rely on her knowledge of kinesiology and on her skill in finding a testing position which to the greatest possible extent isolates the muscle which she is testing. She must develop a fine sense of touch in order to discover the slightest contraction in a muscle. She must learn to feel deeply situated muscles and to differentiate between muscles which lie close together. This is indeed a very subjective procedure.

The muscle charts which are used at the Institute for the Crippled and Disabled allow for the comparative objective recording of movements and for the more subjective grading of individual muscles. Simple joint movements, such as flexion and extension, abduction and adduction, pronation and supination, etc., are listed. The grades for the movements are recorded in the margin. Muscles are listed under each joint movement and space is provided for grading them.

The following scale is used for the grading of movements (adaptation of Lovett method):

O (zero) indicates that no contraction can be discovered in any of the muscles which perform the movement.

T (trace) indicates that some tenseness or a flickering of muscle fibers can be palpated when the movement is attempted.

T+(trace plus) indicates a definite contraction of one or more muscles but the contraction is not sufficient to produce a movement.

P−(poor minus) indicates that a few degrees of the motion can be performed when the action of gravity is eliminated and when friction and other forces acting against the movement have been reduced to a minimum.

P (poor) indicates that at least 50% of the normal range of motion can be performed with gravity eliminated and friction reduced. Patient should be able to repeat the motion at least five times.

P+(poor plus) indicates a range of motion of 50% or more, performed with gravity eliminated but against slight resistance by the technician. Patient should be able to perform the motion at least 5 times.

F−(fair minus) indicates that a small range of motion can be performed against gravity but after a few repetitions fatigue sets in.

F (fair) indicates 50% of normal range of motion against gravity. Patient should be able to perform the motion at least five times.

F+(fair plus) indicates more than 50% of range of motion against gravity. Patient should be able to perform the movement at least 10 times without signs of fatigue.

G−(good minus) indicates ability to perform a movement against gravity and slight resistance. Range of motion should be practically complete. Patient should be able to perform movement at least 5 times.

G (good) indicates ability to perform movement against gravity and moderate resistance. At least 10 movements should be completed without fatigue.

G+(good plus) same as G, but a great deal of resistance is given.

N−(normal minus) there is a normal range of motion with almost normal strength.

N (normal) strength of motion is normal, taking age, sex and general muscular development of the individual into consideration.

N+(normal plus) unusual strength.

For the subjective rating of individual muscles numerals are used:

0—no activity can be discovered in the muscle.

1—feeble contraction or flickering of a few muscle fibers (compare "trace" for motion).

2—definite contraction but very little strength (about 25% of normal strength) (compare "poor" for motion).

3—about 50% of normal strength (compare "fair" for motion).

4—about 75% of normal strength (compare "good" for motion).

5—100% strength (compare "normal" for motion).

INSTITUTE FOR THE CRIPPLED AND DISABLED

MUSCLE CHART

Name.....Address.....

Age.....Sex.....Diagnosis.....

LEFT			UPPER EXTREMITIES	RIGHT		
DATE	DATE	DATE		DATE	DATE	DATE
			SHOULDER GIRDLE			
			STERNOCLAVICULAR AND ACROMIOCLAVICULAR JOINTS			
			ELEVATION: ....Upper trapezius.... ....Levator anguli scapulae.... ....Rhomboids....			
			DEPRESSION: ....Lower trapezius.... ....Lower serratus anterior.... ....Lower pectoralis major.... ....Latissimus dorsi....			
			UPWARD ROTATION SCAPULA: ....Serratus anterior.... ....Trapezius....			
			DOWNWARD ROTATION SCAPULA: ....Rhomboids.... ....Pectoralis minor.... ....Levator anguli scapulae....			
			ABDUCTION SCAPULA: ....Serratus anterior.... ....Pectoralis major....			
			ADDUCTION SCAPULA: ....Middle trapezius.... ....Lower trapezius.... ....Rhomboids....			
			ARM—SHOULDER JOINT			
			FLEXION: ....Anterior deltoid.... ....Pectoralis major.... ....Coracobrachialis.... ....Biceps....			
			EXTENSION: ....Posterior deltoid.... ....Latissimus dorsi.... ....Teres major....			
			ABDUCTION: ....Supraspinatus.... ....Anterior deltoid.... ....Middle deltoid.... ....Posterior deltoid....			
			ADDUCTION: ....Pectoralis major.... ....Latissimus dorsi.... ....Teres major....			
			EXTERNAL ROTATION: ....Infraspinatus.... ....Teres minor.... ....Posterior deltoid....			
			INTERNAL ROTATION: ....Subscapularis.... ....Pectoralis major.... ....Teres major.... ....Latissimus dorsi.... ....Anterior deltoid....			
			ARM—ELBOW JOINT			
			FLEXION: ..Brachialis.... ....Biceps.... ....Brachioradialis.... ....Pronator teres.... ....Extensor carpi radialis longus....			
			EXTENSION: ....Triceps long head.... ....Medial head.... ....Lateral head.... ....Anconeus....			
			PRONATION: ....Pronator quadratus.... ....Pronator teres....			
			SUPINATION: ....Biceps.... ....Supinator....			
			HAND—WRIST JOINT			
			PALMAR FLEXION: ....Flexor carpi radialis.... ....Ulnaris.... ....Palmaris longus.... ....Finger flexors....			
			DORSAL FLEXION (Extension): ....Extensor carpi ulnaris.... ....Extensor carpi radialis longus.... ....Extensor carpi radialis brevis....			
			RADIAL FLEXION: ....Abd. poll. long.... ....Ext. poll. brev.... ....Extensor carpi radialis.... ....Flexor carpi radialis....			
			ULNAR FLEXION: ....Extensor carpi ulnaris.... ....Flexor carpi ulnaris....			
			EXAMINER'S INITIALS			

Notes.....

Prepared by Miss Signe Brunnstrom, New York University

INSTITUTE FOR THE CRIPPLED AND DISABLED

MUSCLE CHART

....Address.....

....Sex.....Diagnosis.....

LEFT			UPPER EXTREMITIES (Continued)	RIGHT		
DATE	DATE	DATE		DATE	DATE	DATE
			THUMB—CARPOMETACARPAL JOINT			
			FLEXION: (with opposition): ....Oppon. poll.... ....Abd. poll. br..... ....Adductor pollicis.... ....Flexor pollicis brevis.... ....Palmaris brevis..			
			EXTENSION (abduction in the plane of the palm): ....Abd. poll. long.... ....Ext. poll. br..... ....Ext. poll. long....			
			ABDUCTION (at right angle to plane of palm): ....Abd. poll. long.... ....Abd. poll. brevis.... ....Ext. poll. brevis.... ....Palmaris longus....			
			ADDUCTION: ....Adductor pollicis obliquus.... ....Adductor pollicis transversus....			
			THUMB—METACARPOPHALANGEAL JOINT			
			FLEXION: ....Flexor pollicis brevis.... ....Flexor pollicis longus....			
			EXTENSION: ....Extensor pollicis brevis.... ....Extensor pollicis longus..			
			THUMB—INTERPHALANGEAL JOINT			
			FLEXION: ....Flexor pollicis longus....			
			EXTENSION: ....Extensor pollicis longus....			
			FINGERS—METACARPOPHALANGEAL JOINTS			
			FLEXION (with extension of interphalangeal joints:)			
			2nd finger: ....Lumb. 1.... ....Int. dors. 1.... ....Int. vol. 1....			
			3rd finger: ....Lumb. 2.... ....Int. dors. 2.... ....Int. dors. 3....			
			4th finger: ....Lumb. 3.... ....Int. dors. 4.... ....Int. vol. 2....			
			5th finger: ....Lumb. 4.... ....Int. vol. 3.... ....Flex. dig. quin. brev.... ....Abd. dig. quin.... ....Opp. dig quin....			
			EXTENSION:			
			2nd finger: ....Extensor digitorum communis.... ....Ext. indicis proprius....			
			3rd finger: ....Extensor digitorum communis....			
			4th finger: ....Extensor digitorum communis....			
			5th finger: ....Extensor digitorum communis.... ....Ext. digiti quinti prop....			
			ABDUCTION (away from middle finger):			
			2nd finger: ....Interosseus dorsalis 1....			
			3rd finger: ....Interosseus dorsalis 2.... (toward radial side)			
			3rd finger; ....Interosseus dorsalis 3.... (toward ulnar side)			
			4th finger: ....Interosseus dorsalis 4....			
			5th finger: ....Abductor digiti quinti....			
			ADDUCTION (toward middle finger):			
			2nd finger: ....Interosseus palmaris 1....			
			4th finger: ....Interosseus palmaris 2....			
			5th finger: ....Interosseus palmaris 3....			
			FINGERS—INTERPHALANGEAL JOINTS			
			FLEXION PROXIMAL JOINT:			
			2nd finger: ....Flex. digitorum sublimis.... ....Flex. digitorum profundus....			
			3rd finger: ....Flex. digitorum sublimis.... ....Flex. digitorum profundus....			
			4th finger: ....Flex. digitorum sublimis.... ....Flex. digitorum profundus....			
			5th finger: ....Flex. digitorum sublimis.... ....Flex. digitorum profundus..			
			FLEXION DISTAL JOINT:			
			2nd finger: ....Flexor digitorum profundus....			
			3rd finger: ....Flexor digitorum profundus....			
			4th finger: ....Flexor digitorum profundus....			
			5th finger: ....Flexor digitorum profundus....			
			EXTENSION PROXIMAL AND DISTAL JOINT:			
			2nd finger: ....Int. dors. 1.... ....Int. vol. 1.... ....Ext. dig. com.....			
			3rd finger: ....Int. dors. 2.... ....Int. dors. 3.... ....Ext. dig. com....			
			4th finger: ....Int. dors. 4.... ....Int. vol. 2.... ....Ext. dig. com.			
			5th finger: ....Int. vol. 3.... ....Abd. dig. quin.... ....Ext. dig. com....			
			EXAMINER'S INITIALS			

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INSTITUTE FOR THE CRIPPLED AND DISABLED

MUSCLE CHART

Name.....Address.....

Age.....Sex.....Diagnosis.....

LEFT — LOWER EXTREMITIES — RIGHT

DATE	DATE	DATE		DATE	DATE
			THIGH—HIP JOINT		
			FLEXION TO 90: ....Sartorius.... ....Rectus femoris.... ....Pectineus.... ....Tensor fascia lata.... ....Adductors.... ....Iliopsoas....		
			FLEXION BEYOND 90: ....Iliopsoas.... ....Sartorius...		
			EXTENSION: ....Gluteus maximus.... ....Adductor magnus.... ....Hamstrings....		
			ABDUCTION: Gluteus medius.... ....Gluteus minimus.... ....Tensor fascia lata.... ....Pyriformis....		
			ADDUCTION: ....Adductor magnus.... ....Adductor longus.... ....Adductor brevis.... ....Adductor gracilis.... ....Pectineus....		
			EXTERNAL ROTATION: ....6 small outward rotators.... ....Gluteus maximus.... ....Biceps....		
			INTERNAL ROTATION: ....Gluteus medius.... ....Gluteus minimus.... ....Adductors....		
			LEG—KNEE JOINT		
			FLEXION: Biceps.... ....Semimembranosus.... ....Semitendinosus.... ....Gastrocnemius...		
			EXTENSION: ....Rectus femoris.... ....Vastus intermedius.... ....Vastus medialis.... ....Vastus lateralis....		
			FOOT—ANKLE JOINT		
			DORSAL FLEXION: ....Tibialis anticus.... ....Peroneus tertius.... ....Extensor digitorum longus....		
			PLANTAR FLEXION: ....Gastrocnemius.... ....Soleus.... ....Peroneus longus.... ....Tibialis posticus.... ....Toeflexors....		
			INVERSION: ....Tibialis anticus.... ....Tibialis posticus.... ....Toeflexors....		
			EVERSION: ....Peroneus longus.... ....Peroneus brevis.... ....Peroneus tertius.... ....Extensor digitorum longus...		
			TOES—METATARSOPHALANGEAL JOINT		
			PLANTARFLEXION: 1st toe: ....Flex. hall. br.... ....Abd. hall.... ....Add. hall.... 2nd—5th toes: ....Lumbricales.... ....Flexor et Abductor digiti quinti....		
			DORSALFLEXION (Extension): 1st toe: ....Extensor hallucis longus.... ....Extensor hallucis brevis.... 2nd—5th toes: ....Extensor digitorum longus.... ....Extensor dig. brevis...		
			TOES—INTERPHALANGEAL JOINTS		
			FLEXION: 1st toe: ....Flexor hallucis longus.... 2nd—5th toes: ....Flexor digitorum longus.... ....Flexor digitorum brevis....		
			EXTENSION: (By pulling on extensor tendons) 1st toe: ....Flex. hall. br.... ....Abd. hall.... ....Add. hall.... 2nd—5th toes: Lumbricales.... ....Interossei....		
			EXAMINER'S INITIALS		

Notes.....

INSTITUTE FOR THE CRIPPLED AND DISABLED

MUSCLE CHART

.....Address.....

.....Sex.....Diagnosis.....

LEFT			RIGHT		
DATE	DATE		DATE	DATE	DATE
		HEAD AND NECK			
		FLEXION: Sternocleidomastoid.... ....Scaleni.... ....Longus capitus.... ....Longus colli.... ....Rectus capitis anterior.... ....Rectus capitis lateralis.... ....Platysma:....			
		EXTENSION: Upper trapezius.... ....Splenius capitis.... ....Splenius cervicis.... ....Semispinalis capitis.... ....Semispinalis cervicis.... ....Longissimus capitis.... ....Longissimus cervicis.... ....Rectus capitis posterior.... ....Iliocostalis cervicis.... ....Obliquus capitis superior.... ....Multifidus.... ....Interspinales....			
		LATERAL FLEXION: ....Sternocleidomastoid.... ....Scaleni.... ....Upper trapezius.... ....Levator scapula.... ....Splenius capitis.... ....Splenius cervicis.... ....Semispinalis capitis.... ....Semispinalis cervicis.... ....Longissimus capitis.... ....Longissimus cervicis.... ....Obliquus capitis superior.... ....Iliocostalis cervicis.... ....Intertransversarii....			
		ROTATION: ....Sternocleidomastoid opposite side.... ....Upper trapezius opposite side.... ....Semispinalis capitis et cervicis opposite side.... ....Splenius capitis et cervicis same side.... ....Longissimus capitis same side.... ....Rectus capitis posterior major same side.... ....Obliquus capitis inferior same side....			
		TRUNK			
		FLEXION: Abdominal muscles (See separate examination below)			
		EXTENSION: ....Erector spinae.... ....Multifidus.... ....Interspinales....			
		LATERAL FLEXION: ....Erector spinae.... ....Multifidus.... ....Intertransversarii.... ....Lateral abdominals.... ....Quadratus lumborum.... ....Psoas major.... ....Latissimus dorsi.... ....Intercostales....			
		ROTATION: ....External oblique opposite side.... ....Internal oblique same side.... ....Rotatores opposite side.... ....Multifidus opposite side....			
		ABDOMEN (Recorded in percentage, Kendall method)			
		ANTERIOR ABDOMINALS: ....Rectus.... ....Internal oblique.... ....External oblique....			
		LATERAL ABDOMINALS: ....External oblique.... ....Internal oblique.... ....Quadratus lumborum.... ....Latissimus dorsi....			
COSTAL MARGIN AND ILIAC CREST			LEFT TOW.	COSTAL MARGIN RT. ILIAC	CREST
		OBLIQUE ABDOMINALS: ....External oblique.... ....Internal oblique....			
		TRANSVERSE ABDOMINALS: ....Transversus....			
		EXAMINER'S INITIALS			

UPPER EXTREMITIES

(Slides and demonstration by Signe Brunnstrom.)

Shoulder Girdle

	Grade	Position	Test and exercise
ELEVATION	Poor	Supine, prone or side lying	Draw shoulder toward ear
	Fair	Sitting or standing, arm hanging at side	Draw shoulder toward ear
DEPRESSION	Poor	Supine, prone, or side lying	Starting with shoulder elevated, depress shoulder, making neck long
	Fair	Supine, prone, or side lying*	Depress shoulder against resistance by examiner. Resistance should equal the weight of the arm
UPWARD ROTATION of SCAPULA (GLENOID CAVITY IS TURNED UPWARD)	Poor	Prone, elbow flexed, arm resting on smooth table, palm down	Slide hand forward on table until arm is extended over head. Observe rotation of scapula. If there is deltoid paralysis, assist movement of humerus
	Fair	Sitting or standing, arms upward bent	Streach arm over head. Observe rotation of scapula. If there is deltoid paralysis, assist movement of humerus
DOWNWARD ROTATION OF SCAPULA (GLENOID CAVITY IS TURNED DOWNWARD	Poor	Prone, arm over head, resting on table, palm down	Pull elbow down to side sliding on table. Observe scapulo-humeral rythm. If there is no rhomboid action the teres major will tend to pull the inferior angle of the scapula toward the axilla, particularly if slight resistance is given
	Fair	Sitting with elbow bent and wrist resting in small of back, shoulder muscles relaxed. Examiner places fingers on tendon of pectoralis minor and other hand underneath medial border of scapula	Raise forearm off the back (examiner's fingers are pushed out from underneathcoracoid process and scapula); assist humerus if posterior deltoid is weak

Arm—Shoulder Joint

FLEXION	Poor	Lying on unaffected side, affected arm resting on horizontal smooth board, elbow flexed, humerus at side	Slide arm on board away from trunk into flexed position. If upward rotators of scapula are weak, assistance is given to scapula
	Fair	Standing or sitting, arm hanging at side	Raise arm forward to flexed position. If upward rotators of scapula are weak give assistance to scapula

* To make shoulder depressors work against gravity, patient should be lying prone on table, trunk over edge, head down. Since this position is unpractical the depression usually is tested as described above.

	Grade	Position	Test and exercise
EXTENSION	Poor	Lying on unaffected side, affected arm resting on horizontal smooth board in flexed position	Slide arm on board from flexed to extended and hyperextended position
	Fair	Prone lying, arm hanging over edge of table in flexed position	Raise arm to side and into hyperextended position
ABDUCTION	Poor	Prone or supine, elbow flexed, arm and forearm resting on smooth table	Abduct arm sliding on smooth surface. Observe movement of humerus in relation to scapula
	Fair	Sitting or standing, elbow flexed, arms adducted	Abduct arm, reaching upward with hands. If upward rotators of scapula are weak, the movement of the scapula is assisted
ADDUCTION	Poor	Prone or supine, arm abducted	Adduct arm, sliding on smooth surface. Observe scapulo-humeral rhythm
	Fair	Lying on affected side, trunk off the table, arm hanging over edge of table in abducted position*	Adduct arm
EXTERNAL ROTATION	Poor	Prone position, arm hanging relaxed over edge of table	External rotation of arm; differentiate between external rotation of arm and supination of forearm
	Fair	Prone position, arm abducted and supported on table, forearm hanging over edge of table	Raise forearm to horizontal, thus rotating arm externally
INTERNAL ROTATION	Poor	Prone, arm hanging relaxed over edge of table	Internal rotation of arm; differentiate between internal rotation of arm and pronation of forearm
	Fair	Supine, arm abducted and outward rotated, elbow flexed to 90°, arm and forearm resting on table	Raise forearm to vertical position thus inward rotating the arm
		Arm—Elbow Joint	
FLEXION	Poor	Sitting, arm and forearm supported in horizontal position, elbow slightly flexed	Flex forearm sliding on smooth surface
	Fair	Sitting, arm at side, elbow slightly flexed, forearm midway between pronation and supination. (For F+ elbow should be extended; for F— approximately 45° starting angle is allowed)	Flex forearm raising hand toward shoulder

*If this position is too difficult for the patient to assume, the test also may be given prone or supine. Resistance is given to adduction. The resistance should equal the weight of the arm.

	Grade	Position	Test and exercise
EXTENSION	Poor	Sitting, arm and forearm supported in horizontal position, elbow flexed 90°	Extend forearm, sliding on smooth surface
	Fair	Prone lying, arm abducted and supported, forearm hanging vertically over edge of table	Extend forearm bringing it to horizontal position
PRONATION	Poor	Prone lying, arm abducted and supported, forearm hanging vertically over edge of table	Pronate forearm
	Fair	Supine lying, arm abducted and outward rotated, forearm flexed to right angle, resting on table	Pronate forearm
SUPINATION	Poor	Prone lying, arm abducted and supported, forearm hanging vertically over edge of table	Supinate forearm
	Fair	Prone lying, arm abducted and supported, forearm flexed to right angle, resting horizontally on table	Supinate forearm
		Hand—Wrist Joint	
PALMER FLEXION	Poor	Sitting, forearm supported on table, ulnar side down; a small rolled towel is placed under the forearm near the wrist; hand is dorsal flexed and fingers allowed to bend	Palmar flex hand, sliding on table; fingers are allowed gradually to extend
	Fair	Sitting, forearm supinated and supported in a horizontal position, hand dorsal flexed by gravity	Palmar flex hand
DORSAL FLEXION	Poor	Sitting, forearm supported on table, ulnar side down; a small rolled towel is placed under the forearm near the wrist; hand is palmar flexed, fingers allowed to extend	Dorsal flex hand, allowing fingers to flex
	Fair	Sitting, forearm pronated and supported in a horizontal position, hand over edge of table; gravity keeps hand in palmar flexed position	Dorsal flex hand
RADIAL FLEXION	Poor	Sitting, forearm supported on table, palm down, hand ulnar flexed	Radial flex hand, sliding on table
	Fair	Sitting, forearm supported, ulnar side down, hand over edge of table	Radial flex hand

	Grade	Position	Test and exercise
ULNAR FLEXION	Poor	Sitting, forearm supported on table, palm down, hand radial flexed	Ulnar flex hand
	Fair	Supinelying or sitting, forearm supported in a horizontal position by examiner in such a way as to make gravity radial flex hand	Ulnar flex hand
Thumb—Carpometacarpal Joint			
FLEXION (with opposition)	Poor	Sitting, forearm supinated and resting in lap; a small smooth board is placed in palm, thumb is extended (abducted in the plane of the palm); thumb resting on board	Flex metacarpal bone of thumb, sliding on board; (this movement is also called opposition)
	Fair	Supine lying or sitting, forearm supported in a horizontal position by examiner in such a way as to make gravity extend thumb (radial side of hand down)	Flex metacarpal bone of thumb, bringing thumb up toward 5th finger
EXTENSION (abduction in the plane of the hand)	Poor	Same position as for "poor flexion," thumb in flexed position	Extend thumb sliding on board
	Fair	Sitting, forearm supported, ulnar side down, thumb in flexed position	Extend thumb
ABDUCTION (at right angle to plane of palm)	Poor	Sitting, forearm supported, ulnar side down, thumb adducted, resting on smooth surface	Slide thumb into abduction
	Fair	Sitting, hand resting in lap, palm up, thumb adducted	Abduct thumb
ADDUCTION	Poor	Same position as for "poor abduction," thumb abducted	Adduct thumb
	Fair	Sitting, hand supported on table, palm down, thumb over edge, abducted by gravity	Adduct thumb
Thumb—Metacarpophalangeal Joint			
FLEXION	Poor	Hand supported, palm up; metacarpal bone is given fixation	Flex proximal phalanx of thumb; note that amount of flexion at this joint varies a great deal in different individuals
	Fair	Same position as for "fair ulnar flexion"; metacarpal bone is given fixation	Flex proximal phalanx of thumb

	Grade	Position	Test and exercise
EXTENSION	Poor	Hand supported, palm up; metacarpal bone is given fixation	Extend proximal phalanx of thumb
	Fair	Hand supported, ulnar side down	Extend proximal phalanx of thumb
Thumb—Interphalangeal Joints			
FLEXION	Poor	Hand supported, palm up; proximal phalanx is given fixation	Flex distal phalanx of thumb
	Fair	Hand supported, radial side down	Flex distal phalanx of thumb
EXTENSION	Poor	Hand supported, palm up, distal phalanx flexed	Extend distal phalanx of thumb
	Fair	Hand supported, ulnar side down, distal phalanx flexed	Extend distal phalanx of thumb
Fingers—Metacarpophalangeal Joints			
FLEXION (with extension of interphalangeal joints)	Poor	Forearm and hand supported, ulnar side down	Flex fingers, keeping interphalangeal joints extended; examine each finger separately
	Fair	Forearm supported, palm up	Flex as above; examine each finger separately
EXTENSION	Poor	Forearm and hand supported, ulnar side down, fingers flexed	Extend fingers; interphalangeal joints remain flexed.
	Fair	Forearm and hand supported, palm down, interphalangeal joints flexed	Extend fingers as above
ABDUCTION (away from middle finger)	Poor	Forearm and hand supported, palm down	Abduct fingers; examine each finger separately
	Fair	Forearm and hand supported; ulnar side down for int. dors. 1 and 2: radial side down for int. dors. 3 and 4 and for abd. dig. quinti	Abduct fingers; examine each finger separately
ADDUCTION (toward middle finger)	Poor	Forearm and hand supported; palm down, fingers abducted	Adduct fingers; examine each finger separately
	Fair	Forearm and hand supported; radial side down for int. palm. 1; ulnar side down for int. palm. 2 and 3	Adduct fingers; examine each finger separately

Fingers—Interphalangeal Joints

Examine each finger and each joint separately following the same principles as above. Care is taken to give fixation proximal to the joint which is being examined.

Note: There is very little difference between "poor" and "fair" in movements of the fingers. The weight of the fingers is so small that the movement is practically as easy to perform against gravity as with gravity eliminated. Contractures and limitation of joint movement must be taken into consideration and subjective judgment relied upon.

LOWER EXTREMITIES

(Slides and demonstration by Marjorie Dennen.)

Thigh—Hip Joint

	Grade	Position	Test and exercise
FLEXION TO 90°	Poor	Lying on unaffected side, affected leg resting on smooth board; hip joint extended	Flex thigh to 90°, sliding on board
	Fair	Sitting, affected leg hanging over edge of table with extension at hip joint or Standing on unaffected leg, affected leg hanging free	Flex thigh to 90°
FLEXION BEYOND 90°	Poor	Lying on unaffected side, affected leg resting on smooth board; thigh flexed to 90°	Flex thigh beyond 90°
	Fair	Sitting on chair, knees flexed, feet on floor	Flex thigh beyond 90°
EXTENSION	Poor	Lying on unaffected side, affected leg resting on smooth board; thigh in flexion	Extend thigh, sliding on board; observe whether or not quadriceps by extending the knee assists in extension of thigh
	Fair	Prone lying, legs hanging over edge of table; flexion at hip joint	Extend thigh, raising leg to horizontal, keeping thigh midway between inward and outward rotation. If the thigh can be extended in outward rotation only it is an indication of weakness of adductor magnus
ABDUCTION	Poor	Back lying, opposite knee bent, pelvis and rib cage in good alignment	Abduct leg, sliding on smooth surface; no movement of the pelvis should be allowed
	Fair	Lying on unaffected side; affected leg should be extended at hip and knee joint; unaffected leg slightly flexed at hip and knee	Abduct leg, keeping knee extended; observe that movement takes place at hip joint; action of quadratus lumborum may look like slight abduction
ADDUCTION	Poor	Back lying, opposite knee bent, pelvis and rib case in good alignment, thigh abducted	Adduct thigh, sliding on smooth surface
	Fair	Lying on affected side, unaffected leg held in abduction by examiner	Adduct lower leg, bringing it up to upper leg

	Grade	Position	Test and exercise
EXTERNAL ROTATION	Poor	Sitting, affected leg hanging over edge of table, hip joint extended, thigh midway between external and internal rotation or Standing on unaffected leg, affected leg hanging free; a block is placed under unaffected foot	Rotate thigh outward
	Fair	Sitting on table, lower leg over edge, knee flexed	Rotate thigh outward, bringing foot of affected side in front of opposite ankle
INTERNAL ROTATION	Poor	Same as "poor external rotation"	Rotate thigh inward
	Fair	Same as "fair external rotation"	Rotate thigh inward, turning lower leg outward, thigh remains resting on table
		Leg—Knee Joint	
FLEXION	Poor	Lying on affected side, with hip slightly flexed, knee almost but not completely extended	Flex lower leg, sliding on smooth surface
	Fair	Prone lying, hip extended, knee slightly flexed; a small pillow is placed under ankle, causing slight flexion at knee	Flex lower leg to 90°
EXTENSION	Poor	Lying on affected side, hip slightly flexed, knee flexed to 90°	Extend leg, sliding on smooth surface
	Fair	Sitting, trunk inclined backward approximately 45°, legs over side of table	Extend leg to horizontal
		Foot—Ankle Joint	
DORSAL FLEXION	Poor	Lying on affected side, knee bent	Dorsal flex foot, sliding on smooth surface; foot midway between eversion and inversion
	Fair	Sitting, lower leg over edge of table	Dorsal flex foot; foot midway between eversion and inversion

	Grade	Position	Test and exercise
PLANTAR FLEXION	Poor	Lying on affected side, knee extended	Plantar flex foot, sliding on smooth surface
	Fair	Prone lying, knee extended, foot over edge of table, small pillow under ankle (To test soleus alone, the knee should be flexed to 90°)	Plantar flex foot
INVERSION	Poor	Back lying, foot slightly everted, heel supported on table	Invert foot
	Fair	Lying on affected side, knee bent	Invert foot, bringing front part of foot off the table, heel resting on table
EVERSION	Poor	Back lying, foot slightly inverted, heel on table	Evert foot
	Fair	Lying on unaffected side, foot over edge of table	Evert foot
		Toes—Metatarsophalangeal Joint	
PLANTAR FLEXION	Poor	Lying on affected side, knee bent, foot at right angle	Plantar flex proximal phalanges
	Fair	Prone lying, knee flexed, lower leg vertical, ankle in neutral position	Plantar flex proximal phalanges
DORSAL FLEXION	Poor	Lying on affected side, knee bent, ankle slightly plantar flexed	Dorsal flex proximal phalanges
	Fair	Sitting, foot supported, slightly plantar flexed	Dorsal flex proximal phalanges

DISCUSSION

Florence P. Kendall, Baltimore:

In regard to "fair" grade: It is quite generally accepted that "fair" means completing the full arc of motion against gravity. I believe we should not deviate from this. In our use of per cent at the Children's Hospital School we have not changed the principles of the key to grading as used in Boston, Warm Springs and other places using similar keys. We have merely translated letter grades into percentages. We are not only satisfied, but we are enthusiastic about this change.

In the outline of muscle tests, there is a column headed by "grade." In this column are listed "poor" and "fair" for each test. I believe the mention of the grade should not appear on an outline designed to describe the test for the purpose of *determining* the grade.

What "poor" actually means is the position of gravity eliminated and what "fair" means is the position in which the movement is done against gravity. I I suggest that the words "gravity eliminated" replace "poor," and "against gravity" replace "fair."

In the outline it is stated: "From the functional standpoint it is more important to grade the strength of movements than of individual muscles. The grading of movements can be made more objectively than the grading of individual muscles and requires less skill on the part of the technician."

I believe we should not be satisfied to do group testing. We may use it as a means toward more accurate testing when people are first learning muscle testing but we should not feel that isolation of muscles in testing is impractical nor that grading individual muscles need be entirely subjective.

If movement were fundamentally the most important factor in muscle function, then group testing and group action of muscles might be sufficient. However, another factor—that of support in regard to muscles of the lower extremity particularly—is a more difficult function and on this basis of difficulty must be considered the more important function. For example, a patient with one normal and one paralyzed or weak leg finds it more difficult to support himself on his weak leg in order to move the normal leg than to move the weak while supporting himself on the

normal leg. As the leg tests show it requires only a poor or poor plus hip flexor to swing the leg forward in the upright position. However, at least a good amount of power is required in the hip extensor and abductor muscles adequately to support the body on the leg while the body weight is entirely on that leg. Nature has a function for every muscle and the loss of even one muscle, especially in the muscles of the legs, means a definite loss of some function. For example—the movement of inversion in plantar flexion which should be performed by a tibialis posticus can be obtained by some substitution of other muscles. However, when standing with the body weight supported on a leg which is deprived of the tibialis posticus power, the foot surely will pronate. In other words, the other muscle may substitute in movement, but it cannot adequately substitute in support of body weight. By examination and careful isolation of muscles we must find the weakness of individual muscles and be prepared to brace or support such a weak muscle before deformity occurs.

Testing the Muscles of the Abdomen*

Florence P. Kendall

One method of testing for abdominal strength is palpation of the abdominal muscles during certain arm, leg and head raising movements to determine the amount of strength and grade of the muscles. There is a wide range of strength in abdominal muscles which palpation cannot determine because, above a certain degree of power, the muscles feel completely firm. Consequently, we need some method of gauging the variation in power above such a point. We have experimented with such grading and in the five years that we have used this method we have found it more and more satisfactory—not only because each examiner feels he has an accurate comparison each time he reexamines the same patient but also because all the physical therapists in the department can grade abdominal power on various patients with almost equal degree of accuracy.

Many factors such as differences in degree of trunk flexibility among various patients, differences in height, age and sex have been and are considered, and we realize that all tests at times must be modified. The tests which will be discussed are used and found satisfactory for the majority of patients.

In the extremities, grade increases are based on the ability of the muscle to hold against increased weight or resistance. The same principle is used in regard to abdominal tests with the difference that the patient's own weight—of legs or trunk—is used as resistance rather than resistance applied by the examiner. There might be objection on the basis that the patient may gain or lose considerable weight, thereby changing the amount of resistance. There would scarcely be as great a difference due to this possibility, however, as would occur when different examiners apply resistance, or even when the same examiner applies resistance at various times, because it is difficult above a certain point to determine whether we are applying several pounds more or less resistance. Using the individual patient's weight of legs and trunk as resistance has proved to be relatively constant and, I believe, accounts for the fact that various persons at different times can examine patients with such equal degrees of accuracy.

Let it be emphasized that the leg raising movement does not constitute the test of the abdominal strength. The position or movement of the legs constitutes the downward weight on the pelvis in opposition to the upward abdominal pull which must maintain the pelvis in such a position that the lumbar spine is flat on the table as the legs are lifted or held in various positions.

OUTLINE OF GRADING ABDOMINAL STRENGTH

(Same as in Public Health Bulletin No. 242, except for a few modifications.)

Before doing test movements for abdominal muscles, test the hip flexors, neck flexors and shoulder adductors to determine whether the leg

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* Originally this discussion was to have been presented by Mr. Henry O. Kendall, but since he was unable to attend the convention, Mrs. Henry O. Kendall, who has worked with him for several years, presented the discussion. She aimed to present, as nearly as possible, the views of Mr. Kendall in regard to these muscle studies.

neck and arm muscles are strong enough to do resistive movements in order to bring in abdominal action. Then test for trunk flexibility forward and laterally, so that restriction of motion will not be confused with muscle weakness.

100 per cent

(1) With hands clasped behind the head, the patient rolls his pelvis backward and "folds" to sitting position. The legs are not supported until trunk flexion is complete but may be supported as soon as the pelvis should normally begin flexing on the thighs. (If hip flexors are weak, the 100 per cent grading should be based on the patient's ability to complete his normal trunk flexion and hold against moderate resistance.)

(2) Arms folded on chest, the patient rolls his pelvis backward and holds his lumbar spine flat on the table as the legs are raised and lowered.

80 per cent

(1) With arms folded on the chest, the patient rolls his pelvis as above and "folds" to sitting position.

(2) With hands clasped behind the head, the patient rolls his pelvis as above to flatten the lumbar spine. The examiner then raises the patient's legs to an angle of approximately 40 degrees from the table and asks the patient to keep his back flat on the table while holding the legs in that position.

60 per cent

(1) With arms down at side (but with no assistance from hands or elbows), the patient rolls his pelvis and "folds" up to sitting position.

(2) Same as (2) under 80 per cent except that legs are held at an angle of approximately 60 degrees.

50 per cent

(1) With arms down at side, the patient is able to roll his pelvis and lift his head and shoulders about 4 or 5 inches from the table.

(2) Same as (2) under 80 per cent except that legs are held at an angle of approximately 75 degrees from the table.

30 to 40 per cent

With knees slightly flexed (blanket roll under them) have the patient roll his pelvis as above and raise his head. The patient is able to approximate the pubis and the sternum as the head is lifted for 30 per cent, and as the head is lifted against moderate resistance for 40 per cent.

20 per cent

The patient is able to approximate the pubis and sternum as he rolls the pelvis and depresses the chest, but as the weight of the head is lifted, the rectus "gives" and the thorax is elevated.

5 per cent

The patient can "set" or tense the abdominal muscles slightly but is unable actually to approximate the pubis and sternum in attempting the pelvic roll. Depend on reflex action and palpation for grading.

Lateral Abdominal Muscles

Before doing the following abdominal tests, test for the strength of the leg abductors, arm adductors and lateral neck flexors.

100 per cent

Trunk flexion laterally in side-lying, to point of patient's maximum lateral flexion (which averages about 10 to 12 inches in adults.)

80 per cent

Trunk flexion laterally in side-lying: the under shoulder is raised about 4 inches from the table.

50 to 60 per cent

Trunk flexion laterally in side-lying: the under shoulder is raised 1 to 3 inches from the table.

30 to 50 per cent

Firm fixation and approximation of the rib cage and iliac crest laterally during active leg abduction and arm adduction against moderate resistance in side-lying. 30 per cent—weight of arm and leg. 50 per cent—weight of arm and leg raised against moderate resistance.

20 to 30 per cent

Ability to approximate iliac crest toward rib cage laterally in side-lying but the lateral abdominals "give" and the distance is increased as the weight of the leg is raised in abduction or the arm is adducted against moderate resistance.

10 to 20 per cent

Supine: Ability to draw the pelvis up laterally, tightening the lateral abdominals.

0 to 10 per cent

Supine: Palpate for tone, when patient attempts to draw up hip or adduct arm against slight resistance.

Oblique Abdominal Muscles

(These tests are for the external oblique and the opposite internal oblique.

100 per cent

With arms folded on chest, raise the patient diagonally in trunk flexion and rotation until both shoulders are well off the table and ask the patient to hold that position. (Assistant holds legs.)

80 per cent

(1) With arms as above, have patient raise one entire shoulder region off the table rotating it toward the opposite hip. (The shoulder region should clear the table below the scapula while the other shoulder is lifted slightly from the table.)

60 per cent

With examiner giving moderate resistance to a diagonally downward pull of the arm and a diagonally upward pull of the opposite leg, the costal margin on the side of the arm should be strongly approximated toward the opposite iliac crest, and on palpation the cross sectional muscles will be very firm. The amount of resistance the leg will take is not the important thing because that involves hip flexor action. The examiner must observe how well the patient can hold the "pelvis rolled" as resistance is applied against the leg. In the arm movement, it is the ability of the patient to tighten the external oblique holding down the rib cage as the pressure is exerted against the arm.

If the arm is weak, pushing up the shoulder away from the table against resistance may be substituted. However, if the leg is weak, do not substitute a "hip roll" movement with the heel resting on the table, because the hip extensors can raise the hip from the table and the abdominals will be stretched rather than brought into active contraction. Lifting the hip in an attempt to roll it toward the opposite costal margin will be an exercise or test movement only if the patient or the examiner can raise the leg slightly from the table as the hip is rotated, permitting no downward pressure by the hip extensors.

30 to 40 per cent

The patient is able to hold the back flat and approximate the iliac crest toward the opposite costal margin as he raises the leg actively (that is, against no resistance) and pulls the arm obliquely against slight resistance.

5 to 20 per cent

If the weight of the leg and slight resistance against the arm causes separation rather than approximation in the diagonal pull as above, have the patient attempt to tighten the muscles pulling the costal margin toward the opposite iliac crest. Depend on palpation and reflex action for grading.

Gaits

Alice Lou Plastridge

INTRODUCTION

This discussion of gaits takes the form of a description and demonstration of some of the typical limps which follow an attack of poliomyelitis. It goes into detail about the different muscle groups involved and describes the importance of each in relation to standing and walking. It points out the dangers of "habit limps" and illustrates some of the ways of preventing them. It gives as the aims of supervised walking: (1) making the gait smooth, steady and inconspicuous, (2) making the gait as rapid as possible, with safety to the individual and to weakened muscles, and (3) making walking not merely an expedient means of locomotion but a constant corrective training toward normal walking. It also touches on such allied subjects as getting in and out of a chair, stair climbing and the use of apparatus.

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DISCUSSION

In all of our work with the aftercare of poliomyelitis, both physicians and physical therapists strive for months or even years to prevent deformity and to increase muscular strength. Our ultimate goal, of course, is independence—just

as complete an independence as it is possible for each patient to attain. We know that the last, the hardest and most important phase of their whole development and their treatment, the culmination of all that has gone before, is learning to walk—on the level, on an inclined surface, on uneven ground, and, which is hardest of all, to go up and down stairs.

For moderately affected patients, especially children or young adults, all this is comparatively simple and fairly easy. However, all too often they are fitted with braces, crutches, canes or whatever is indicated and allowed to go home and learn to walk as best they can with no particular instruction or supervision. Sometimes this is quite successful, but more frequently the results are far from what could be expected or desired.

Unless a great deal of thought is given to the accuracy of each motion, some very serious and injurious, as well as unsightly, habit limps can be formed in the very beginning which are extremely difficult to overcome even after the muscles have regained their needed strength. It takes more than good apparatus and an ambition to walk to accomplish this feat successfully.

A visible handicap of any kind is unfortunate, but with poliomyelitis patients we can do a great deal to minimize this: (1) by helping them to make their walking as inconspicuous as possible by teaching them to move quietly and steadily without needless body, leg or arm motions which would attract attention to their disability; (2) by helping them develop a gait which is as rapid as possible, with safety to the individual and to his weakened muscles, and (3) by making their walking not merely an expedient means of locomotion but a constant corrective training toward normal walking, however far removed that goal may seem to be.

The muscular involvement and the alignment of the body are the factors which determine if or how a person will get about. It is sometimes surprising to see how a little power in an essential place may permit walking, whereas a lot of power in less essential spots and the lack of it where it is needed may prevent walking at all. Also it is just as surprising to see how some malalignment or deformity like a severe knockknee, a bow leg, a short leg, a hip flexion or abduction contracture, a varus foot or a scoliosis may necessitate such a complete shifting of weight that anything approximating a normal gait is impossible, even though the muscles may be strong enough to have permitted good walking. These "muscle pictures" are so different and so complicated that each case is a law unto itself and each one must be treated as an individual problem.

Careful training and patient practice sometimes may produce amazing results in poliomyelitis gaits. On the other hand there are a certain number (fortunately few) who will find it more practical and a great energy-saver to carry on their lives very actively and successfully in a wheel chair. With their particular combination and severity of muscle involvement it often is wiser to face the fact that greater independence sometimes may be had in a wheel chair.

There are several ways of using crutches successfully. The most common is by using a "4-count" gait, where the crutch is placed forward first, then the weight is shifted onto it so that the opposite foot can be moved. While the weight is still on the first crutch, the other crutch is brought forward, the weight shifted to it, and then the other foot moved. If the hip and trunk muscles are fairly good, a more rapid walk can be developed by using one crutch and the opposite foot simultaneously. Sometimes when only one leg is affected and that quite seriously, particularly about the hip, there is much less strain upon it if both crutches and the weak leg are used together.

There are times when it seems advisable to teach swinging on the crutches (that is, swinging both legs forward at the same time); first, when, because of extreme trunk, hip and leg weakness, ordinary crutch walking is impossible. A patient starts by trying to get a little hop. At first it results merely in dragging the feet forward an inch or so, but gradually this may be increased until the feet come up to the crutches—but never through them. Until the abdominals are strong it would not be safe because it would decrease the size of the walking base too much and make balancing too difficult. Frequently this type of walking will increase the power of the lower abdominals considerably and we sometimes give this as a strengthening exercise rather than as practical means of locomotion. When the trunk and arms are good, swinging through the crutches is very easy and becomes a rapid means of getting about. Long distances can be covered with much less fatigue and strain. It is also an excellent way of teaching coordination. Swinging often puts across the idea of getting momentum, making progress and gaining speed which materially improves the other types of walking. Swinging is of value from another therapeutic angle in helping to stretch out or prevent a scoliosis. When there is marked muscular asymmetry in trunk and hips the even pull of this method of walking is far better for the back than extreme "hike" on one side and a bad drop or twist on the other.

Swinging can be the most graceful, rhythmic and inconspicuous way of getting along if it is done well.

Occasionally we find it advantageous to cut off the top of the crutches and substitute a metal band or leather strap. In instances where the arms and the gluteals are fairly good, but not good enough to discard crutches entirely, these so-called "Canadian" crutches give more stability than canes but are not as cumbersome as high crutches. They are also useful in teaching a person to use the arms in walking and not to hang on the tops of the crutches. This is particularly true of little children. This type of crutch is almost necessary if a patient wears a high corset or jacket or some apparatus that has attachments running up under the axillae. The top of an ordinary crutch is so thick and high that it pinches the skin between itself and the jacket and becomes very painful.

When the arms and shoulders are normal, the trunk muscles good and the hips stable enough to maintain good balance, a pair of canes can be substituted for crutches. The technique for using them is the same as for crutches—using the four count or the two.

If only one leg is involved (whether braced or not) and the rest of the body is normal, one cane, used in the hand opposite the weak leg, is a great help in keeping the body symmetrical and preventing the lurching and tipping which is so common and so conspicuous a limp. Canes should be short enough to allow the arms to be almost straight. A little flexion at the elbows gives a better chance to push the body weight from one hip to the other, but too much flexion takes away the leverage and makes the canes very unstable and of much less value.

To instill confidence in a patient when he embarks on this hazardous road of walking, especially crutch walking, it always is wise to have two people to assist. One standing in front and one behind gives him a much greater sense of security and allows him to concentrate on the actual walking rather than on the fear of falling. For a tall individual especially, the ground is a long way down. Giving thought to this aspect of self-confidence, along with all the other things included in the supervision of walking, will help a patient materially in making of it a constant corrective training toward normal walking.

The scapular and arm groups are quite essential in giving stability for crutch walking. The upper trapezius and pectorals are useful in getting a crutch forward when the deltoids are paralyzed. The triceps is necessary in keeping the elbow extended to give more spring to the motion when bearing down on the crutch and to prevent "lying" on top of the crutch. This pressure on the axillary nerves can cause a "crutch paralysis." Metal or leather triceps bands can be riveted on the crutches, just above and behind the elbow, to assist in keeping the elbow extended. If the finger flexors are not strong enough to grasp the hand piece, a strap may be fastened between the two uprights across the back of the wrist. This keeps the hand from slipping off and allows the crutch to be raised.

On first thought one would not consider the latissimus dorsi a "walking" muscle, but when crutches are used it becomes very important. If crutches are necessary in the presence of a weak latissimus dorsi, the arms become the stationary point toward which the hip must be raised to take a step. However, there is no power to pull the hip up and thus shorten the distance between the hip and the shoulder sufficiently to lift the foot from the ground. There is no "push power" from the arm to get the necessary trunk fixation on which to "hike" the leg. The whole side sags and the leg must be dragged forward. If other conditions will permit it, a wide shoulder strap fastened to the corset will help hold the shoulder down. Then weight can be placed on the crutch without the shoulder "riding" upward, and the leg can be lifted more readily. A fascial transplant from the scapula to the spine helps to give better fixation.

There are certain definite and characteristic positions and limps caused by muscle weaknesses. These can become unnecessarily exaggerated without constant and careful supervision. For instance, when anterior abdominals are extremely weak, in order to center the weight over the hips, the tendency is to flex the hips and extend the spine to the point of an exaggerated lordosis. The abdomen protrudes like a typical "pot belly." When walking is attempted it is almost a waddle. A well-fitted corset, strong enough and high enough to exert three-point pressure, often will decrease this condition and give a much better chance for the return of abdominal power by not allowing such constant stretching. If, in addition to this abdominal weakness the leg and hip muscles are extremely weak, walking is very difficult when crutches and braces are necessary. A typical tripod position is used which tends to decrease the lordosis when standing still; in walking, however, because there is no fixation power between the ribs and hips against which the hip flexors can pull to raise the leg, the body is thrown backward far enough to take up the slack in the weak abdominals. This causes an extreme hyperextension of the spine. The head is thrown back also

but at the beginning of each step the head is thrust forward as if to give the necessary momentum to pull the trunk forward. In this instance, the principal value of body support is partially to limit the extreme lordosis, for the upper thorax is pulled up over the top of any corset no matter how well fitted. If shoulder straps are used the garment rides up and leaves the lower abdomen and lower back unsupported. Peroneal straps in addition to shoulder straps are too painful. In such cases the abdominal fascial transplant can be quite effective in giving fixation without the extreme lordosis and abdominal stretching.

When taking a step, an asymmetrical weakness in the lateral trunk groups causes a dropped pelvis on the weak side—a so-called Trendelenberg limp. Probably of this whole group, the quadratus lumborum is the most important. Without it there is no "hiking" power. If, however, there are strong abdominals on the side of the weak quadratus lumborum, the pelvis can be tilted backward and the leg raised on that side by the action of the abdominals; while the other leg can be "hiked" up and the pelvis tilted forward on the side of the good quadratus, giving an anterior-posterior rocking motion to the pelvis with each step. When two long braces are worn there must be a more symmetrical "hiking" of the pelvis to bring each foot off the ground, unless, of course, the leg is allowed to swing sideways and then forward (which is awkward and unsightly). Occasionally this has to be resorted to if the lateral trunk muscles are too weak to "hike" the leg and the hip on the opposite side too weak to carry the weight. The wearing of one long brace instead of two is sometimes a detriment as far as the symmetry of the action of the pelvis is concerned, for if the patient is not careful he will of necessity "hike" the braced leg but the other side he may drop as in a Trendelenberg limp, even with a good quadratus, either because of weakness in the hip on the braced leg side or simply from lack of effort or lack of corrective instruction.

With weak back muscles, the pelvis is tilted backward, the hips are hyperextended, the lower back rounded backward, the chest flattened and the head thrust forward, producing a characteristic posture. A weakness in the upper back with good lower back and abdominals will cause an upper dorsal kyphosis with forward head.

Total paralysis of all the trunk muscles makes standing or walking very precarious and makes sitting difficult. The most careful balancing is necessary at all times to keep the body weight centered over the hips. The slightest push in any direction would upset the equilibrium. Crutches and a corset help to stabilize this condition, but walking is very difficult even with normal upper extremities.

The gluteals are very essential for getting in and out of a chair—either forward or backward. If two long braces are worn, a person must turn in the chair and get up backwards. Then in placing the feet properly for weight-bearing he usually has to step backward from the chair if his legs are short, or forward if they are long, before attempting to raise the trunk. At this point, if the quadratus lumborum is weak, the leg must be lifted with the back muscles before the gluteus can push the leg back or extend the hip enough to get into the upright position. The spinal extensors and the arms are under great strain—so getting up in this manner is impossible without fairly good arms—especially the triceps groups.

Of the hip muscles, the gluteus maximus is probably the most important for standing and walking. It might be described as the connecting link between the trunk and the legs and the muscle which has so much to do with maintaining an upright position. If the gluteus maximus on one side is weak, the hip is thrust forward and the trunk thrown diagonally backward on that side to prevent the pelvis from tipping forward. This puts a great strain on the quadriceps, and if it is at all weak it usually necessitates wearing a long brace. If both gluteus maximus groups are extremely poor, crutches will be needed in order to stand upright, and then it can be done only if the hips are hyperextended. Otherwise the body "jackknifes" forward at the hips and the patient literally "sits down" backwards. In cases of a bilateral hip flexion contracture in the presence of gluteal weakness—even a moderate contracture—walking is very difficult. Practically all the weight is borne on the arms with the body tilted forward. A lordosis also is present. The hip flexion contracture must be reduced before a normal posture can be attained.

Weakness in the hip abductors causes the pelvis and body to shift sideways over the affected leg when weight is placed on it. The arm on that same side is thrown out to counterbalance the weight of the other leg when it is lifted. This is a very common limp. This same limp becomes more complicated if there is weakness in the lateral trunk muscles of the opposite side. In this instance when the weight is placed on the affected leg, the hip protrudes laterally and the trunk seems to shift to the opposite side, allowing

the dropping of the pelvis on that opposite side (a typical Trendelenberg position). This makes a very uneven and ugly gait. If this particular hip and trunk condition persists it can become a habit position. It often is first detected in the lying position. Over a period of time it can cause an abduction contracture of the good hip with a corresponding adduction of the weak leg. The pelvis becomes tilted upward on the weaker side where it shows the protruding hip, and the lateral trunk muscles become shortened; while the abducted side becomes lower and the hip flattened, and the lateral trunk muscles stretched. The whole line of weight bearing is changed and the good leg appears longer than it really is, even though both legs are the same length by actual measurement. This is apparent when walking is attempted because it is so much more difficult to bring the good leg forward than the weaker one. If a lift is placed on the shoe of the apparently shorter leg it does not even up the pelvis but makes the tilt more exaggerated and increases the scoliosis. If this condition has progressed to the point of a fixed, structural scoliosis, the lift on the shoe may be the only solution for getting a patient to walk.

With weakness of the hip adductors there is no apparent limp but weakness may be detected by placing one foot in front of the other, as in walking a chalk line. In walking, the feet are usually set wide apart and this is sometimes alluded to as the "snow shoe gait."

When the hip flexors are poor the most common mode of walking is to throw the entire side of the body forward because there is no ability to lift the leg and place it forward. Usually the head and trunk are thrown backward and the leg is dragged forward with extreme difficulty—the leg making a semicircular movement. (With hip flexor weakness stair climbing is most difficult. Usually it is necessary to go up either sideward or backward.) If the back muscles also are weak and crutches or canes are used, the entire picture is changed. The crutches are placed far ahead and the body bent forward from the hips, putting more weight on the arms. When the bending is sufficient to take up the slack on the back muscles, the whole side of the body is raised upward sufficiently to lift the foot from the ground. Then the weight of the leg and the force of gravity bring it forward.

With hip rotator weakness the lifted leg turns in or out as the case may be; but when weight is placed on the weak leg, the foot is the fixed point and as a consequence the pelvis is twisted. In inward rotator weakness when weight is placed on the weak leg the pelvis swings backward on the good side and that buttock becomes prominent; also the length of the step on the good side is shortened. Outward rotator weakness is manifested more by an inward rotation of the leg.

With quadriceps weakness there are several ways of walking with an unbraced leg. (1) The simplest way is to turn the leg in outward rotation. The knee, being a hinge joint, cannot bend against its inner surface with forward momentum. The joint is locked against the internal lateral ligament. (2) Sometimes a little pressure from the fingers on the thigh (given through a trouser pocket or on top of the thigh) may be a great help in keeping the knee straight. (3) If there is a knee flexion contracture, the pressure from the hand must be heavier and nearer the knee, causing the body to be bent forward. In all these positions the center of gravity must fall in front of the knee to keep it from "buckling." (4) If the knee flexors are weak the knee can be hyperextended to lock it. (5) When there is an equinus of the foot, walking on the front of the foot tends to lock the knee automatically. (6) With other muscles normal, it is fairly easy to walk with a weak quadriceps by bending the body forward at the hip each time the weak leg is used, but if both quadriceps are affected, the body does not come up to the erect position until locomotion has ceased. (The knees are sometimes flexed and the heels off the ground.) As soon as the body is lifted upright, the weight is no longer in front of the knees and more strain is placed on the quadriceps, causing them to give way and let the person fall. Long leg braces, locked at the knees, would give the needed support and allow a person to walk upright with very little difficulty. If, in this instance, both hamstrings are strong, the biceps femoris could be transplanted forward into the patella to give stability enough to discard braces. (7) Stair climbing with a weak quadriceps is difficult because after the foot is placed upon the step there is no way of lifting the body except by straightening the knee. Great care should be taken to keep the body bent well forward before the knee is straightened. The tendency is to place the foot on the step above, stiffen the knee by twisting the body backward on that side and then literally "pry" the body up with a hyperextended knee and a pull of the arms. This puts too much strain on the hamstrings.

A good gluteus maximus is a tremendous help when the quadriceps is weak. The gluteus maximus extends the thigh and straightens the knee automatically when the foot is fixed; then very little power is needed in the quadriceps to keep

the knee straight unless a sudden blow behind the knee makes it buckle.

Hamstring weakness shows itself mainly in the hyperextended position of the knee in standing and walking. It also causes an arrhythmic gait. A long brace will protect the joint and keep the structures at the back of the knee from becoming stretched.

Weakness of the gastrocnemius and soleus causes a serious limp and makes it appear that the whole leg is involved. The step has no spring. The heel does not leave the ground until the whole foot is picked up because it has no power to "push off." Instead, the toes grasp the ground, the foot is shortened and the heel is brought toward the toes, causing a marked cavus position of the foot. The motion is somewhat like that of an inch worm. The real "push off" is made by keeping the knee slightly bent, then straightening it suddenly when ready to step forward with the other foot. This gives the forward impetus to the body. Building up the heel of the shoe sometimes helps to minimize this limp.

When the anterior tibial and dorsal flexors of the foot are paralyzed, there is a loss of ability to raise the forefoot from the ground when standing and when the leg is raised the foot dangles so that the knee has to be raised quite high to allow the toes to clear the ground. When the next step is taken there are two distinct sounds—the toe touches first, then the heel. This limp can be recognized as far as it can be heard. When the hip flexors also are weak, a great deal of difficulty is experienced in getting the leg forward. Sometimes the trunk muscles "hike" it part way while the hip abductors swing it sideways until it clears, then a twist of the pelvis may fling it forward. This often is accompanied by a so-called "peroneal flip" when the peroneals are strong enough to evert and raise the outer border of the foot, thus shortening the length of the leg.

When peroneals are weak the foot turns into varus and the tendency is to walk on the outer border of the foot.

If the posterior tibial is weak the foot tends to turn into valgus—or so-called flatfoot position.

Especially when a shoe is on, strong toe extensors aid in dorsal flexion of the foot. Strong toe flexors aid in keeping the balance whenever a person is standing. They grip the ground even in a shoe and give additional stability.

From this brief description and demonstration of gaits you can see some of the problems evolving from muscle weakness and especially from the infinite number of combinations of weaknesses.

Our task, therefore, is to give careful and painstaking study to each case in order to develop for them the mode of locomotion which will be the easiest, the safest, the least conspicuous and which will cause them the least fatigue.

The school of animal magnetism was founded by *F. A. Mesmer*, who was born in 1734 at the Bodensee and from 1766 on was a well known and popular physician in Vienna. In the year 1774 he began to treat patients, suffering from all kinds of diseases, with a steel magnet. He soon discovered, however, that the magnet was superfluous, because through his personal influence alone, by slowly stroking the painful parts, he could effect most astonishing cures. He explained his success on the ground that apparently some human beings have the gift of mobilizing healing forces in others through their own magnetic force, and he believed in it himself throughout his life. The guild physicians (barbers, surgeons, midwives) of Vienna and Paris branded his system quackery, but he was the adored idol of a large number of successfully treated patients. —From "German Medicine" by W. Haberling.

The Sitting Position in Relation to Pelvic Stress

C. L. Lowman, M.D.

Appreciation of the influence of faults in the sitting position on growth and function of the trunk aids in solving many of the posture problems of childhood, such as trunk distortions from infantile paralysis, scoliosis and others. In the study of the problem of low back pain, few examiners take into consideration the fundamental relation of the pelvic bones and muscles as a base of support and action of the structures above and below them.

The common procedure seems to be to inspect the standing posture, front, side and back; then to put the examinee through various bending tests, noting the limitations and estimating by inspection and palpation the position of the pelvis. The patient is next requested to lie down; leg lengths are measured and a variety of tests for joint motion, muscle spasm, etc., of legs and trunk are carried out—prone and supine. X-rays of spine are next in order and too often are taken only in the lying position. When these are returned they are compared with the findings obtained by the clinical examination and history.

Seldom is there any specific study of the sitting position or any inquiry into the habits of posture related to it. The habit of sitting on one foot or on unsuitable occupational chairs or seats may have very important relation to static stresses, producing or contributing to sacrolumbar symptomatology or growth disturbances in pelvic bones and spinal column.

The support of the body in sitting erect is the tuberosities of the ischial bones and the fleshy parts of the thighs and buttocks; and in sitting slumped the end of the sacrum makes contact with the seat. Reference to the skeleton shows that the tuberosities are prominences formed by the rami of the ischium and pubes. Their undersurface upon which a person sits is about an inch wide and is curved with the convexity down. This curved area varies in extent of size and thickness according to the general weight and structural development of the individual. Proportioned to the stresses of muscle pulls, it averages from one and a half to two inches in length.

In changing from the slumped position of sitting (with the pelvis slanting backward and the spine in flexion in the lumbar area) to the position of sitting erect (with the pelvis straight up or a little forward and the lumbar spine extended) a rocker action of this curved ischial bearing surface takes place.

In the normal pelvis these ischial tuberosities are placed symmetrically about four to six inches apart, angulated from behind forward outward and upward in the frontal plane. In the sagittal plane the ischial bones are angled outward and upward towards the acetabulae where they join with the ilia to form the os-inominata or lateral halves of the pelvis.

The examination of many hundreds of patients in the sitting position over the past quarter of a century convinces me that lateral obliquity of the pelvis is of much more common occurrence than one would suppose. I presume that at least some degree of obliquity was noted in at least twenty to thirty per cent of all those examined in an extensive clinical practice.

From the intra-uterine stage through to adolescence, changes in muscle pull and weight stresses may alter the symmetry of bilateral position of the ischial tuberosities in relation to the frontal plane of the body, or laterally in relation to the inclination of the ischii—sagittally. As the pelvic ring has its closing segment formed by the sacrum posteriorly, it is obvious that any alterations in development of the articulations in the sacroiliac joints may influence the symmetry of the pelvis posteriorly. Developmental faults in the iliac, pubic and ischial bones will have the same effect above and below—anteriorly.

Thus, a condition of distortion of the whole pelvis known as tortiopelvis may occur. As in the standing position, the relation of the two ends of the bicoxal axis to the frontal plane may be altered by a twist in the pelvis; just so in sitting will such a twist influence the bi-ischial axis. Likewise, just as the anteroposterior movement of the pelvis on the femoral heads is influenced, so, in sitting, the same forward back movement on these ischial rockers is affected.

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Read before the Western Orthopedic Society, San Francisco, California, September 1940.

In shifting the pelvis forward and back on these ischial rockers as a center, the top of the sacrum moves forward and back through a considerable arc—the forward movement being checked by the limits allowed by the interarticular processes and the backward movement by the limits of compression of the vertebral discs and the impingement of the tip of the sacrum on the chair.

If a pelvis is wholly level, both ilia travel forward and back through equal arcs and in the same relative direction, but with the presence of the common varus position of one ischium the inominate on that side rocks through a different plane than its fellow. If there is a lateral tilt as well, the varus increases and the shift from slumped to erect position shows a marked difference, as compared with opposite side, of all points of the ilium.

To ascertain pelvic asymmetry, have the patient sit on the end of the examination table with the flexure of the knees exactly at the edge and the knees equidistant from the center line. From behind, place the thumbs in the hollow below the posterior superior spines of the ilia on either side, allowing the hand to cup itself over the curve of the crest; the tips of the middle fingers extended to, or towards, the anterior superior spines. Ask the patient to slump as though sitting in a soft chair. Note the level of the posterior spines. Press the hand into the loin and palpate the flares of the ilia and difference in the crests. Then, have the patient change to the erect position, and, noting any change in height of each posterior spine, feel the increase of the outward flare of the ilium if it happens to be the low side.

Pass around in front of the patient and palpate the anterior spines in both positions, noting any change above or below the level. If a simple lateral tilt exists, all points will be equally low, front, side and back on the one side as compared with the opposite. If, however, any torque in the pelvis exists and the direction of the roll on the ischial rockers is not alike, one posterior superior spine will be low in slumped position, with anterior spines level (or higher on the same side) as the low posterior spine. A shift to erect position may bring this low posterior spine to level or to a higher position than its fellow, while the corresponding anterior spine will be much lower than its opposite.

Palpation of the anterior flared portion of the ilium will show that in this erect position it tends to flare outward in a flatter plane, whereas in the slumped position the ischium seems to rock back into a greater varus position. This rocking of the pelvis, with the point of maximum curvature further forward or back on one side than the other, may be likened to a loose, rickety rocking chair, the seat of which tilts and twists in rocking forward and back, on rockers that tilt laterally and are out of parallel.

When this twisting action is present, asymmetry also occurs in the movement at the lumbosacral junction which is no longer the same on the two sides. When the individual slumps and the ilium moves backward more on the side of the low posterior superior spine, there is a backward drag on the corresponding iliolumbar ligament on that side; that is, because of its attachment to the lateral process of the fifth lumbar vertebra, that vertebra is rotated backward on that side. In sitting erect and in standing, the opposite side (the side of the higher posterior superior spine) rocks further forward and the iliolumbar ligament of that side drags the fifth lumbar forward in the opposite rotation.

If there is a tendency to lordosis, with the upper end of the sacrum approaching the horizontal, the combination of obliquity in two planes increases the intrinsic torque in the pelvis. It also causes more tension on these ligaments and a greater drag on the lumbosacral articulations. *

Furthermore, when either or both of the interarticular processes between fifth lumbar and first sacral are of the crescentic or flattened type, the structural stability at this vital point is reduced. This allows the fifth lumbar to shift forward so that the ligamentous stress is still further increased.

When this flattening of the interarticular processes is unilateral and occurs on the side of the forward shift of the ilium, the rotation of the fifth vertebra forward tends towards a one-sided or hemispondylolisthesis which, in x-ray studies, shows little if any displacement of the fifth lumbar on the first sacral. However, it is a common finding that a large percentage of low back and sciatic cases have as a chief point of pain, aching or tenderness in the iliovertebral triangle over and along the iliovertebral ligaments. This evidence of stress has been cited before in the article referred to above.

The daily minute trauma, both dynamic and static, around the sacrolumbar junction is well known. The production of periosteitis and of peliositic reactions about the forminal exits, with

*Lowman, C. L.: Role of Ilio-lumbar Ligaments, J.A.M.A., Sept. 1926.

congestion and swelling in ligamentous and synovial structures, will at times account for so-called "sciatic attacks." The recognition of pelvic malalignment, such as the deviations mentioned, is essential to both corrective and preventive treatment.

Regarding the influence on growth, superincumbent weight falling on an inominate bone which has an increased outward obliquity is going to make itself felt in the ilioischial epiphysis which runs through the acetabulam. The tuberosity of the ischium on that side is going to be the point of resistance to this gravitational force; hence, the ischial portion of the bone will tend to move inward to a greater position of varus, and thus will tend to widen or flatten the acetabular cup.

This will make for incongruence of the hip joint with resultant changes in the femoral head. Commendable was Jansen's idea that in instances where there is insufficiency of amniotic fluid, the sitting position of the fetus allows the muscular pressure of the uterus against the ischii to produce an ischium varum with changes in the hip sockets making them wider and flatter.

If a small child makes a habit of sitting with one thigh abducted and inwardly rotated and the opposite leg flexed acutely (usually the left for right-handed children) with the foot drawn in out of the way, the weight is shifted to one side in leaning on the left hand, particularly when the foot is carried under the ischium or thigh of the opposite side. This downward and lateral thrust of the weight of the body can become so habitual as to produce a deformity. The varus deviation, we have found, is most frequent on the left side. The deformity produced may provoke compensatory changes in muscles and skeleton above. The torque in the pelvis may never be noted until some dressmaker or physical director calls attention to the fact that one hip is more prominent than the other.

The habit of sitting on one foot often continues even into adult life and may become an important factor in producing pelvic distortions and scoliosis. When any nutritional disturbance such as a frank rickets or a borderline arthreptic tendency also exists, deformation naturally will be promoted faster and to a greater extent during growing years.

Jansen pointed out that fast growing cells are the most vulnerable. As forty per cent of growth takes place in the first two years of an infant's life, and it will sit far more than it will stand during this time, sitting in an asymmetrical way is likely to start these moderate pelvic deformations very early. Between the ages of five and ten years children sit many hours at school and also a great deal at play, so that any existing faults tend to increase.

As yet we have not determined whether or not this condition is hereditarily structural with physiological readjustments. The condition, however, has been found so often in connection with low back and sciatic pain that it seems logical to assume that alteration of ligamentous stresses occurs. Stretching on the one hand and contracture on the other follow in disturbed alignment and, as Atsatt has pointed out, reflex irritative stimuli to the viscera may be set up which ultimately may produce actual visceral pathology.

In our experience it has been common to have patients state that menstrual pain and irregularities have been improved or corrected when postural correction of pelvic deviations has been instituted. Consequently, is it not logical, in cases of growing children, to relieve asymmetrical ligamentous stresses, at least until after puberty?

Parents with static faults who were being treated for low back symptoms frequently have brought in one or more children for a check over and exactly similar deviations to the parent's have been found in the child. I do not feel that anything but good can be accomplished by instituting preventive or corrective measures for that child.

Before adolescence, in anticipation of maturation, there is a speeding up of pelvic and body growth, and deviations from symmetry may develop into major deformities very rapidly. These are especially prevalent in girls, due to their greater development of the pelvis at this time.

It is interesting to note that an anterior spine or crest of one side may be one-half to one inch higher than its fellow, but it needs only one-fourth to three-eighths inch under the low ischium to bring it to level. This is due to the fact that the low point is the center, and the farther away on the radius from it, the greater is the deviation.

To correct this condition, either by influencing growth or by removing stress in cases of sacrolumbar strain, for many years we have used what we call a "sitpad." A pad of felt of the desired thickness is sewed into a boy's trousers, or a piece of felt three by four to five inches is encased in a slip of stockinette and suspended below the buttock by tapes from a girl's corset, girdle or belt. To the lower corners of this pad other tapes are sewed by which it is loosel

tied around the thigh so that wher the hip joint flexes the pad is drawn under the tuberosity.

For patients who do not wish to be bothered with wearing the "sitpad," we suggest carrying a magazine of appropriate thickness to slip under the low ischium when sitting. From an occupational standpoint, tilting the chair seat may accomplish the same purpose.

It has also long been my observation that many cases of low back pain and sciatica are adversely affected by faulty sitting position in an automobile. Not only is the height, width and tilt of the seat important but also the relation to the back rest and the sag of the cushion under the person's weight.

Salesmen and others whose occupation require many hours of driving frequently are relieved of their symptoms by having their automobile seat repositioned and the cushion stiffened. In some instances sitting on a lightly padded piece of veneer board is useful. The outer frame of an automobile cushion is stiffer than the area towards the center. Hence, after a period of use, the sag developed there allows a lateral tilt. Many drivers sit with the left elbow up on the door frame, which habit produces a bad spinal alignment, and in addition they are likely to pull down the hat brim on one side and tilt the head.

Add to the static stress of maintaining steadiness of hand and eye by shoulder girdle stabilization the extrinsic stress on the pelvic muscles incident to the continuous fine instrinsic use of lower leg and foot muscles required to operate the throttle, and it will readily be seen that these observations on driving position have definite foundation.

SUMMARY

1. Correction of the faults in sitting is important.
2. Pelvic deviations in form and function are more common than generally supposed and frequently are overlooked.
3. Treatment of low back strains, as well as postural faults of the trunk, is incomplete unless attention is given to sitting faults.

Understanding the Needs of the Crippled Child

Agnes P. McGavin, M.D.

Down through the ages man has been seeking a better understanding of the make-up of the human organism. He has been aware that there was something over and above that of mind and body. From these earlier endeavors was developed the study of personality which has progressed at a rapid rate during the past twenty years.

Plant* sums up this progress somewhat as follows: "There was first the belief that the personality was to be defined in terms of deeds or acts. When this was not sufficient explanation we began to ask who and what is this person who acts, who is delinquent or sick? We then went a step further and considered personality as the integration of the individual into his whole life, each experience being dynamically interwoven into every subsequent one and all the currents of his earlier life coloring and controlling his present picture. Today we are inclined to say the act has been integrated into the actor, and the actor has been integrated into his whole life; but can this life be wholly understood except as it is integrated into the cultural pattern past and present?" Thus we see that personality has come to be considered as the individual's psychophysical make-up modified by his total life experience in his total environment. Therefore, when we begin to work with the physically handicapped child we cannot off-handedly label and pigeonhole him as a deformed limb or a crooked spine, paying little attention to the fact that attached to that limb or spine is a total personality reacting to and within a total environment and that there is a steady interplay of factors—physical, intellectual, emotional, as well as social; economic and cultural.

Accepting this fact, can we attack Johnnie's problem simply on the basis that his difficulty has been diagnosed as infantile paralysis, imposing limitations which he seems to resent and which his family cannot enforce? Looking at the situation from the standpoint of a total personality behaving with meaning within a given environment, should we not pause to ask ourselves: What type of person is this boy? What does this

Director, Child Guidance Service, Children's Hospital, Buffalo, N. Y.

* Plant, James S., M.D.: Personality and the Cultural Pattern. The Commonwealth Fund, New York, 1937.

disability mean to the boy himself? Why can he not accept its limitations? Is it the restriction of the physical handicap which is upsetting him, or is this outward expression of resentment satisfying a deeper inner need? What is his place in the family unit? How does he feel towards the other members of the family, and how do they feel towards him and his illness? Why is he the disrupting element in the classroom? Is it because his intellectual capacities cannot meet the demands of the grade, or because he is emotionally unable to take his place in group life at his age level? What are his interests and how can he most satisfactorily express them in his way? Is reading and handicraft work his interest or our idea of his interest? It is only when we ask ourselves such questions and attempt to answer them that we begin to see the entire situation and can help to set in motion within the boy himself and within his environment forces that will enable him to meet his needs. We see then that we can no longer place the "Johnnies," no matter what their disability, simply in the group of "physically handicapped children," but we must think of them as we do of all children, in terms of individuals, each with his own particular heredity, his emotional make-up, his instinctive drives, his habits, his particular environment and reactions to it. We must apply the same techniques in our work with the crippled child which we use in dealing with any other child, for physical disability becomes significant to us only as it limits the individual's ability to function to the utmost of his capacities and to contribute to his social group.

As we begin to work with the individual we need to be aware of the basic needs of every child at the various stages of his physical and emotional development, for only then can we appreciate the meaning to him of his disability, which varies to a considerable extent with the period of life at which it occurs. If Freddy, at the age of three or four, had developed infantile paralysis it would have had a different meaning for him than it has now when he is eleven years of age. It might have, in the earlier years, hindered him from developing correct habit patterns and conditioned him for life; but the meaning of this particular type of disability for Freddy would not have been quite the same, nor his emotional adjustment to it as difficult as it is at the present period of his life—the period of between eight and twelve years——the gang period—when manliness is of such importance to every boy.

Personal appearance is more important to Alice, aged sixteen, than it was at the age of nine or ten, as the adolescent is much more conscious of a physical handicap or anything that detracts from his appearance than is the younger child. In dealing with the adolescent we should be aware of this, as it may interfere not only with his establishing contacts with the opposite sex but also with achieving emancipation, the prime emotional needs of that period.

The effect of a handicap varies with each child not only because of his heredity and personality but also on account of the type of disability, the time of onset and the length of incapacity in keeping with his needs as they exist for him at his particular stage of growth. Growth is a continual process, and unless we understand it as such we cannot move on with the child, as those things which helped to develop his capacities to the maximum at the prepuberty period are not sufficient for his needs at puberty. It might be interesting now to tell of Anne who had developed infantile paralysis when a few months old and had been brought to the attention of the Guild when two years of age, a helpless youngster with severe contractures and with little ability to do anything for herself. When five years of age she was fitted with double leg braces and a corset and began to walk. During her early developmental years, aside from having "moody" spells and temper tantrums occasionally, she seemed fairly content and was not overly-conscious of crutches or braces. Today at fifteen and a half Anne's needs have changed. Now an adolescent she feels the urge to assert herself and stand on her own feet. "I am supposed to go out and mix with other children. They will not wait for me. They hurry and leave me behind, and my back brace sticks out and people see it and feel sorry for me. I want a pair of slacks to cover up my leg braces." She makes no friends with the opposite sex and very few of her own. She thinks now of the future, sees herself frustrated in the business world "because no one wants a secretary who wears a brace." She resents the overprotection of the teachers in the day school for crippled children, to which she took no exception before and was overjoyed at the transfer to a regular public high school where "no one comes running up to you when you fall down, asking if you are hurt." She discards the back and leg brace occasionally at the weekend "because I really don't need them." It is only through an understanding of Anne's growing and varying needs, external and inherent, that assistance can be given the girl to work out her own adjustment.

We must also keep in mind the fact that the

child's reaction to the disability is the result of its meaning to him and of the purpose it serves him in his effort for adjustment as a particular individual in a particular setting at a particular time.

Mary, aged ten, an unwanted child, the victim of a broken home, had for the first time received a sense of her own importance since entering the Guild for the treatment of a birth injury, as she was showered with attention from not only her mother and stepfather but also from her own father, whom she had not seen in years. She was given all kinds of expensive gifts but still did not seem to be satisfied, always demanding more. Mother, in order to overcompensate for her feelings of guilt at rejecting the child, continued to baby her on visiting days and answer her whims. We ask ourselves, "What purpose does this experience fulfil? What meaning does it assume?" She gains the semblance of love and the recognition and the security she had been denied, so we cannot blame her for using this means to gain her end, but we must assist mother and child to a more wholesome relationship.

Behavior is not only determined by all that a child has to react with—his physical, intellectual and emotional make-up, but it also shapes itself within the home. It is within the home that the fundamental habit patterns are laid which make or mar the personality development of the individual, as it is parental attitudes that constitute the most significant factor here.

Grace, aged thirteen, suffering from spastic hemiplegia, has been overprotected and babied all her life. She has never been given any responsibilities at home, mother making all decisions for her, so that she is totally unequipped to meet the demands of group pressure at school and ends by being a most unhappy person. Instead of carrying the burden for her, mother had unwittingly thrust a heavier burden on Grace, which interfered much more than the physical handicap with the girl's capacity to function independently, to find satisfaction in social relationships and to contribute to the group.

We have touched on a few of those "complex factors" as they relate to the individual. Space does not allow us to go into the various physical, social, economic and cultural aspects which play such a role in the shaping of his destiny. But we have attempted to show from the few illustrative cases that for the cripple as "for every child understanding and the guarding of his personality is his most precious right."

The Treatment of Peripheral Vascular Disease*

William Bierman, M.D.

The type of treatment administered for the improvement of the circulation in peripheral vascular disease depends upon the character of the pathology—whether it be that occurring in thrombo-angiitis obliterans, arteriosclerosis, Raynaud's disease, phlebitis, embolism, et cetera. Although these diseases are systemic in their extent, their major manifestations are evident in the lower extremities. Fortunately it is possible to improve the condition of those who suffer from peripheral vascular disease because the size of blood vessels can be increased and new blood vessels can be stimulated to form.

Many methods have been advised for the treatment of peripheral vascular disease. We have had the opportunity of evaluating some of these both clinically and objectively by means of changes in oscillometer and plethysmographic studies and more particularly by means of changes in the temperature of the skin surface of the toe and of the calf muscles. It is our impression that this objective data has given us a clearer concept of the usefulness of different treatment techniques. Evaluation on a clinical basis only is difficult on account of the necessity of observing large numbers of patients for periods of many years and because of the natural remissions which occur.

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* The author wishes to express his appreciation for the cooperation of Drs. M. Friedlander and S. Silbert in many of the investigative determinations to which reference is made.

After a condition of circulatory insufficiency has become established in the extremities, measures aimed at improving this condition are both preventive and active.

PREVENTIVE MEASURES

The extremities of people who suffer from these diseases are readily susceptible to damage. So simple a procedure, for example, as the cutting of the toe nails, if not carefully performed, may lead to the development of gangrene and the necessity for amputation. The skin of the feet should be cleaned carefully, dried and kept soft with olive oil. Strong chemicals such as those which ordinarily are employed in the treatment of athlete's foot should be avoided. Exposure to cold should be prevented inasmuch as a low temperature can cause a further diminution in the circulation. This is shown by the temperature changes occurring in the muscles of the leg when an ice bag is placed on this area. The intramuscular temperature may drop more than 20 degrees F. A cold draft of air likewise will produce a lowering of temperature although not to so marked a degree. These observations indicate clearly the necessity for warm covering particularly during the winter time.

The climate in which an individual lives is of importance. Raynaud's disease, in contrast to thrombo-angiitis obliterans, occurs most commonly in women. Here the arterial spasms are apt to occur on exposure to cold. For this reason these sufferers are advised to live in a climate which is warm the year round. Similarly a warm winter climate is of help to the arteriosclerotic.

It is essential that those who suffer from peripheral vascular disease do not smoke. Persistence in this habit may be sufficient to negativate any therapeutic measures employed. This is due to the fact that tobacco causes vasoconstriction.

ACTIVE MEASURES

In addition to the systemic treatments, for example, the administration of insulin and a dietetic regime in diabetes, emphasis is placed upon the local applications. These are of three types: surgical, chemical and physical.

Surgical: The developments in other methods of treatment have greatly diminished the necessity for amputations. However, this must be resorted to on occasion. The arteries of the extremities can be caused to contract when the sympathetic nerves going to them are stimulated. For this reason surgeons have cut these nerves so as to produce sympathetic nerve paralysis. Where there is a capacity to respond to this procedure the blood vessels dilate. It was generally believed that this vascular dilatation occurred in the muscles of the extremity as well as in the skin. Our own studies, however, indicate that sympathetic paralysis, while producing vasodilatation in the skin, does not cause any change in the circulation of the muscles. Application of heat to some other part of the body, for example, the immersion of the forearm in hot water, will cause an increase of the circulation of the skin but not of that of the muscles of the leg. This holds true for other techniques aimed at the production of sympathetic paralysis, such as the injection of alcohol paravertebrally, spinal anesthesia, and others. Sympathetic surgery, therefore, is of value in increasing the circulation of the skin, but inasmuch as this can be produced by simpler and less hazardous methods, it is a question whether this type of surgery is worthwhile. It has been found that cutting the sensory nerves and approximating the cut ends gives quick relief to patients suffering from severe pain. This procedure facilitates the local treatment of ulcers. Sensations in the foot return within a few months.

Chemical: A large number of drugs have been offered to the profession to improve the condition of the sufferer from peripheral vascular disease. I shall refer to only a few of these. The salicylates cause an increase in the circulation of the skin and a slight increase in the muscles. This action may account for their value in this disease as well as their use in other conditions, such as arthritis and rheumatic fever. Pancreatic tissue extract also causes a dilatation of the blood vessels of the skin but no change in those of the muscles. In our experience it has been of little clinical value. Intravenous injection of hypertonic salt solution (5 per cent) causes a very definite rise in the temperature of both skin and muscle of the leg. This objective as well as clinical observation tends to show that this is a very valuable measure in the treatment of thromboangiitis obliterans. Alcohol produces an increase in circulation of both the skin and the muscles of the lower extremities. The drinking of whiskey, therefore, should not be discouraged in those who suffer from peripheral vascular disease. Quite the contrary, it should be recommended. This, of course, is no warrant for the drinking of quantities sufficiently large to cause inebriation.

Physical: The number of physical techniques applied for the treatment of peripheral vascular disease has increased during the past few years. Until a short while ago only one such technique

was commonly advised, namely, the application of heat. There was a lack of appreciation of the fact that it is necessary to be careful about the heat dosage. Too much heat can be harmful. This can be understood from a realization of the physiologic changes produced on the elevation of the temperature of a part. An example is the changes caused in the pressure values in the capillaries and in the tissue spaces surrounding them. It has been shown by Landis that in a comfortable environmental temperature the pressure in the arterial side of the capillary loop amounts to about the equivalent of 32 mm. of mercury while on the venous side of the loop the pressure is about 12 mm. of mercury. In the intercellular spaces the value is about 26 mm. of mercury. There is thus a pressure gradient so that plasma tends to flow not only within the closed circulation of the capillary but also from the arterial side through the tissue spaces into the venous side. When the temperature of the finger is raised to 107 F. these pressure changes become markedly altered. Thus the pressure in the arterial side of the capillary loop may rise to 60 mm. of mercury, that of the venous to 45 mm., while the intercellular pressure remains at about 26 mm. The normal trend of the plasma migration from the arterial to the venous side of the capillary loop thus becomes interfered with and it tends to accumulate in the intercellular spaces. This accounts for the swelling of a part to which heat is applied.

An excellent method for the application of heat is the use of a thermostatically controlled leg cradle, the temperature of which is maintained at about 93 F. This is probably the most important physical measure which can be utilized in the treatment of peripheral vascular disease. The heating element in this hood consists of a photothermal source. We have not as yet evaluated the influence of such heat applications upon the temperature of the muscles of the leg. Following the application of a 260-watt carbon filament lamp within a reflector there was marked elevation in temperature in the skin, subcutaneous and muscular regions.

Higher temperatures, particularly those induced by conversive techniques, so as to elevate the temperature of the structures inside the leg as well as on its surface, may be of greater value in those cases which can tolerate such larger quantities of heat. When using the conversive heating measures there is danger of introducing too much heat in the diseased part. For this reason some physicians apply these energies to the region of the lower back and thigh rather than to the foot and leg. It is the duty of the clinician to determine the character and the temperature of the heating measures which can give the greatest benefit. In the presence of circulatory disease, the tissues can be damaged more easily than when the circulation is normal. For this reason it is necessary to be particularly careful in applying heat. A hot water bottle, for example, may produce a burn, recovery from which may be very slow. Other simple techniques which are also valuable are the use of immersion foot baths at a temperature of about 95 F. and of the whirlpool bath.

As in many other conditions, rest is an important consideration. Its pain relieving value is discovered by the patient himself who develops pain upon walking. He finds it necessary to stop until the circulation catches up, as it were, with the increased metabolic demands of the tissue. Rest in bed is necessary where gangrene threatens. There is danger, however, in too much rest in that the circulation-stimulating effect of exercise is lost. That exercise does cause an increase in circulation of both the skin and muscle of the lower extremities has been determined by many others and by ourselves. Passive exercise exerts a similar influence although to a much less extent. In circulatory disorders the so-called Buerger exercises have a place. In the conduct of these exercises the leg is elevated above the head until the foot becomes blanched. It is then permitted to be dependent until the foot becomes red, and then to lie horizontally on the bed for three to five minutes. The tilting bed is a mechanism for the automatic application of changes in posture. Massage can cause an increased circulation in skin and muscles of the lower extremities.

In inflammation of the veins, it frequently is necessary to elevate the leg. In the presence of acute inflammation further retardation of the arterial flow in the leg is accomplished by means of cold applications. Such diminution in arterial circulation is of value in this instance because of the inadequacy of the return flow through the veins.

Following its introduction a few years ago, large claims were made for the use of intermittent positive and negative pressures applied to the lower extremity by means of a leg boot. Clinical experience of many men tends to show that this apparatus is of limited value. Similarly with a somewhat more recent development—intermittent venus occlusion. Our temperature studies have shown that this causes a rise in skin temperature but not in the temperature of the muscles. If this is all that it accomplishes, it would appear simpler to use the thermostatically controlled heating hood.

The
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Arrangements for the 1941 conference at Asilomar are progressing very nicely. Many of our membership who are in school systems have felt the need of some method with which to gain physical therapy units toward an advanced degree. The present plan initiates such an opportunity.

With the growing recognition of physical therapy, many technicians not in school systems find that additional training is of great advantage. These classes may be taken for themselves alone, even though a higher degree is not particularly desired. This one summer's work of six units to be gained during vacation and conference time we hope will be a most auspicious beginning to more courses of this type. Special arrangements with Stanford University permit this study to be done at the San Francisco campus and during the National Conference.

These courses of study, as taken from the Stanford bulletin, are as follows:

Advanced Kinesiology. 2-5 units (Worthingham)

The study of kinesiology in relation to certain corrective physical education and physical therapy procedures.

Therapeutic Gymnastics. 2-5 units (Worthingham)

An analysis of the purposes, techniques and possible results to be obtained from the use of therapeutic gymnastics.

Study of a Special Problem in Physical Therapy. 2-5 units (Worthingham)

Skeletal Muscle and Motor Activity in Health and Disease. 3 units (Chor)

A summary of the normal and pathological, anatomical, physiological and chemical characteristics of muscle. Particular emphasis will be placed on therapy in muscle disorders.

Psychology of the Invalid and the Handicapped. 2 units (Chor)

A study of the reactions to illness and affliction consisting of (a) review of the general principles of psychology as related to personality development. (b) The role of organic and psychological factors in determining the reactions of the individual. (c) Comparison of normal behavior with neurotic and psychotic patterns. (d) Is there a special psychology of the invalid? (e) Special case histories and demonstrations.

We are particularly fortunate that we have been able to secure Dr. Herman Chor, of Northwestern University Medical School, as a special lecturer. His outstanding work at Northwestern insures his value to the members of the American Physiotherapy Association. It is hoped that many will find it possible to take one or both of his courses.

Miss Catherine Worthingham is not only our President but is Assistant Professor of Hygiene and Physical Education for Women at Stanford University, and it is through her efforts climaxing those of the Association that these intensive courses are available.

Besides the final week of these above courses, round table discussion groups led by someone of our membership will be held at Asilomar. The National Committee Studying Muscle Testing will have a discussion group, and the advanced kinesiology class will be combined with it, according to present plans. Miss Alice Lou Plastridge, Chief Physical Therapist at Warm Springs Foundation, is chairman of the Muscle Testing Committee and will lead the discussion group. Her experience and knowledge will make this round table of inestimable value to all who are doing muscle training. There will be other groups in electrotherapy and problems of crippled children's schools and problems of physical therapy schools. A leader for each of these groups will be announced later. Each of these round tables and

classes are to meet for two hour periods each day.

The Northern California Chapter is planning means of making the stay of those attending the courses in San Francisco more enjoyable. San Francisco itself has many intriguing features, and close by are many lovely and interesting places. Although you are in San Francisco for study, there will be time to enjoy extracurricular activities. Regular plans by the hostess chapter are assured for entertainment during the conference. The atmosphere of Asilomar itself will provide much of the recreation—living by groups in cottages, and the gatherings in the lounging room with its great fireplace bring their rewards in friends made and horizons widened.

Make your plans now to be on the Pacific Coast June 22nd to July 18th,—or, at least, July 13th to 18th.

The importance to every member of our association of the special study on muscle testing cannot be underestimated. Miss Plastridge, the chairman, has urged that all chapters consider this in their educational program during the current year. Many members may feel that since they are not working with paralysis cases that this does not apply to them. However, there is no branch of physical therapy that is not affected by such a study. To know the action and to ascertain the strength of the individual muscles whether it be in a fracture, a nerve injury or in cerebral palsy is as important as it is in anterior poliomyelitis. It is necessary for every member to participate in and contribute to her chapter study group if this project is to be worthwhile. The results should be of value not only to us as technicians in perfecting our treatment but also to the patient who will benefit from more understanding care. We urge that every member avail herself of this opportunity to take part and to give of her experience and knowledge in this important study.

Exhibits

Start the New Year by planning exhibits for convention!

Prizes will be offered for exhibits in three classes: motion pictures, posters with drawing or photographs, and models of apparatus, equipment or miniatures of departments. A first prize of $25.00 will be given in each class. Prize winning exhibits become the property of the American Physiotherapy Association, with the exception of the prize winning motion picture of which a copy will be made. These exhibits will be shown at national and local meetings of physicians, nurses, physical education groups, hospital groups, physical therapy groups and societies for crippled children.

Exhibits will be judged on the basis of scientific content, execution, originality and adaptability for exhibit purposes.

The following subjects have been suggested for exhibits:

I. Posters.
   a. Bed position in hospital or home care of infantile paralysis.
   b. Technics in physical therapy treatment of torticollis, brachial palsy, club feet and Colles' fracture.
   c. Improvised equipment, braces, walkers, over-head reading racks, etc.
   d. Posture.

II. Models, additions to the miniature rooms which we now have as an exhibit. New rooms showing the home, hospital and school care of infantile paralysis.
   a. Hospital room with a respirator (orthopedic model), etc.
   b. Special school treatment room.
   c. Two rooms in the home showing kitchen and bed room with a visiting nurse set-up.
   a, b, or c to be considered a complete exhibit for competition.

III. Motion pictures. A picture of not less than two hundred feet, showing physical therapy procedures or technics either in black and white or color.

The committee will welcome additional ideas. Please write to the exhibits committee, Margaret S. Winters, Chairman, 950 E. 59th Street, Chicago, Illinois, for further details before making an exhibit, as exhibits for competition must be made according to specifications.

Western New York Chapter

Miss Violet M. Engler, a member of this chapter, was married on November 20, 1940, to Mr. Kenneth G. Mills.

New York Chapter

Miss Irene Ashbee, former president of the New York Chapter, was married on October 11, 1940, to Mr. Robert K. Osborne.

Katharine Lorrilliere Memorial*

"In these troubled days when all thinking people are overwhelmed with a sense of frustration and hopelessness, it is encouraging to know that there is one very practical way in which we can express our sympathy and our wish to be of service to the handicapped children in Greece. Few of us may have had the privilege of sacrificing our lives that others may have a better chance to live,'" but all can appreciate the work done by Katharine Lorrilliere, a member of our Association, at the center for crippled children of the Near East Foundation in Athens, Greece, before her tragic death last August brought her life of usefulness to a close.

Miss Lorrilliere left the Association for Crippled and Disabled in Cleveland, Ohio, in the Fall of 1937, and went "to inaugurate the first center for the care and education of crippled children in Greece. She found that there were 5,000 of them in Athens alone and 25,000 throughout the country. There was no organized effort in their behalf. Miss Lorrilliere threw herself wholeheartedly into preparing the way and setting up an organization. Her radiant personality, her mastery of the principles and techniques of her chosen profession, her courageous facing of the stark and terrible need soon deeply impressed and secured the support of the social, philanthropic and government leaders . . .

"Workers pass away but the work goes on. Miss Lorrilliere conducted the first demonstration in physical and occupational therapy and elementary schooling in a small clinic and school. The children came from one-room 'homes' with clay floors and little sunlight, without fruit, often without milk and without the privilege of group play or school.

"From the very beginning of her work with crippled children, Miss Lorrilliere had dreams of a camp for outdoor therapy and the necessary water treatment. In 1938 the first camp was limited to a selected number of the most needy cases. In 1939 the camp achieved great success, making unusual records with children who had appeared hopelessly crippled. For months Miss Lorrilliere, despite war clouds, fought for the 1940 camp program, and early in July opened what promised to be the most successful summer period. No sense of frustration or hopelessness ever dismayed Miss Lorrilliere as she struggled with the twisted and broken bodies of those children who put their trust in her. By a devoted, loving absorption in a struggle with difficult, warped child life she challenged the interest of a city of a million people. That challenge must not be forgotten, and the beacon of hope she lighted must be carried by others.

"The work founded and carried on so successfully by Miss Lorrilliere must be continued. The place where her work was done is henceforth to be known as 'The Katharine Lorrilliere Memorial for Crippled Children,' and Miss Alice Carr, of the Near East Foundation, Director of Health and Nursing, will continue to give supervision to the center. It is hoped that Miss Lorrilliere's friends and other lovers of unfortunate children will not only maintain the center she started but will help to carry out some of her plans for the enlargement and extention of the work. To this end a movement has been started to perpetuate her influence and a gift of $1,000 has been received. Other gifts, large or small, are needed."

The Executive Committee, on behalf of the American Physiotherapy Association, has made a contribution to this Katharine Lorrilliere Memorial Fund, and it is hoped that individual chapters will make chapter contributions to help in this work. It is suggested that various projects might be organized in order to raise money for this purpose. All contributions should be sent to the Near East Foundation, 17 West 47th Street, New York City.

*Quotations from pamphlet and communications from the Near East Foundation.

"Canada At War"

Upon the outbreak of the present war, the Canadian Physiotherapy Association appointed a Military Affairs Committee to deal with problems of the organization of physiotherapists for War Service, and the Association promptly offered its services to the Government.

It was recalled that in the War of 1914-18, there were few properly qualified physiotherapists in Canada, and in January 1917, the Canadian Government inaugurated six-months' courses in Orthopaedics and Physiotherapy, which were discontinued in June 1919. This inadequate training, which was the best that could be obtained in the limited time, did not, naturally, obtain the maximum results in the treatment of war injuries, and the Canadian Physiotherapy Association was anxious that only the best-trained people available should be placed in our Military Hospitals during this war.

Since the last war, however, physiotherapy has made rapid strides in Canada. In 1929 the first University of Toronto Course in Physiotherapy was started, due to the efforts of the Canadian Physiotherapy Association. It is a two-year course, with training in Massage, Remedial Gym-

nastics, Electrotherapy, Hydrotherapy, Heat and Light Therapy. The teaching in Anatomy and Physiology is intensive during the whole period of training. The graduates are qualified to undertake all forms of physiotherapeutic treatment for disease and disability under medical direction. After graduation, they are required to spend six months' internship, under supervision, in a recognized civilian hospital.

During the present war, the Physiotherapy Service has become a recognized part of the Royal Canadian Army Medical Corps, and only physiotherapists who are well qualified are being employed in Military Hospitals. They hold the relative rank of 2nd. Lieutenant. Some are already serving Overseas, with Canadian Hospital Units, and others expect to follow.—*Report submitted by Canadian Physiotherapy Association.*

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Infection of Thoracoplasty Wounds: Experiences with Ultraviolet Irradiation of Operating Room Air. R. H. OVERHOLD and R. H. BETTS. Abst. from J. Thoracic Surg., June 1940, in J.A.M.A., Aug. 10, 1940.

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ABSTRACTS

John S. Coulter, M.D.

Improved Technic for Removal of Semilunar Cartilage and Postoperative Treatment

Harold R. Bohlman, M. D. In J.A.M.A., 115:-26:2243, December 28, 1940.

Fifteen years ago the author was impressed with difficulties attendant on internal derangements of the knee. In 1927 he began aspirating joints and injecting air before and after operation as a matter of routine. This experience indicated hemorrhage as probably the greatest disturbing factor. Much blood in the joint before or after operation may result in irritation, infiltration, swelling and thickening of the synovial membrane and ballooning of the joint capsule.

Adequate x-ray examinations are made from whatever angle may be indicated. The state of the joint from the standpoint of arthritis is noted. A general investigation is next carried out. Possible focal infections are searched for. Next a careful history is taken of wound healing, whether or not ordinary scratches or cuts heal by first intention or are prone to fester. In the latter event a patient is checked with Burky's toxin for sensitivity to staphylococcus toxins and, if necessary, a course of intradermal injections of Burky's toxin is given to raise immunity.

Careful blood studies are next carried out with special reference to the cell and platelet counts, bleeding time, clotting time, clot retraction time and the prothrombin time.

In the operation local anesthesia is preferred by the author. A tourniquet never is used. A short longitudinal or slightly oblique parapatellar incision is preferred but this is varied, depending on the size and structure of the knee and the associated internal derangement. All bleeding points are carefully clamped or coagulated by the suction tip with the high frequency electrocautery. The cartilage is then cut along its base, the vascular area being avoided. The entire posterior portion is removed. Damage to articular surfaces is carefully avoided, as is excessive manipulation of the joint. All enlarged or disturbed portions of the subpatellar fat pad are removed.

Lavage with physiologic solution of sodium chloride washes up any loose bits of tissue, indicates any bleeding points, clears the wound of air-borne bacteria and prevents drying of the raw tissue surfaces. The joint is then filled with physiologic solution of sodium chloride; the syn-

ovium is carefully mattressed with fine black silk sutures, as are the remaining layers of tissue. The skin is closed with lock stitches of the same material.

The patient is permitted to sit up in bed the same day and is allowed up in a wheel chair on the third day with the affected leg horizontal. Many patients are permitted crutches on the fifth day. The splint is removed on the sixth or seventh day; also the stitches. The joint is then aspirated of any fluid and its character noted. Both passive and active motions are started. Increments of activity with regard to amplitude of motion and weight bearing are gradually and steadily increased. Patients who do not have complications bear almost their full weight on the twelfth day and use a cane on the fifteenth day. Many have been returned to full activity with no disability three weeks from the day of operation.

Injection of air is of great help in convalescence.

The Treatment of Arteriosclerosis Obliterans: Social Significance and Ultimate Objective

Irving S. Wright, M. D. In J. A. M. A., 115:11: 893, September 14, 1940.

The trend in recent years has been toward conservative therapy as against radical surgery. Marked success has resulted from this trend in the treatment of the organic occlusive disease—thrombo-angiitis obliterans. The major amputation rate, which formerly averaged about 70 per cent, is now averaging from 3 to 10 per cent in several leading vascular clinics. Arteriosclerosis obliterans has been less responsive to conservative therapy for numerous reasons. In spite of these handicaps, definite improvement in the amputation rate has been achieved by the selective and considered use of the following important technics and medications:

1. Rest of the involved extremities in a controlled temperature of from 88 to 94 F.

2. Soaks and baths at similar temperatures, using only mild solutions such as saline, boric acid or azochloramide in triacetin 1:500.

3. Heat applied to the abdomen, producing reflex vasodilatation.

4. Postural exercises, preferably passive, by means of the oscillating bed described by Sanders.

5. Pressure-suction boots in a few selected cases.

6. Alcohol in the form of spirituous liquors by mouth.

7. Deproteinated and other pancreatic tissue extracts by intramuscular injections.

8. Extreme general care in the protection of the feet.

9. Meticulous attention to any open lesions, using only correct technic in their care.

10. Control of diabetes or other complications.

11. The judicious use of the sulfanilamide compounds in the presence of infections, selection being based on the organism present, if possible.

Of almost equal importance is the necessity of avoiding:

1. The use of tobacco.

2. The use of heat greater than 96 F., applied to the extremities—especially in the form of hot water bottles, heat pads, infra-red, diathermy and short wave machines.

3. The use of strong antiseptics.

4. Meddlesome surgery in unskilled hands.

Refrigeration in Cancer: Pathologic Observations in 100 Advanced Cases

Lawrence W. Smith, M. D. In New York State J. Med., 40:18:1355, September 15, 1940.

A review of the pathologic findings observed in a series of 100 cases of human cancer subjected to reduced temperatures either locally, generally, or in combination, is presented. In accessible tumors where local temperatures of 40 to 50 F. can be maintained, there is observed a regular regression in the size of the tumor mass. Histologically such tumor tissue shows degenerative changes going on to complete necrosis and the local disappearance of the tumor on occasion.

The effect of generalized reduction of body temperature upon distant tumor metastasis is variable. In the majority of cases regression in size of such tumor masses is observed grossly. Microscopically, changes similar to those observed in the local refrigeration frequently are found but vary greatly in extent and rarely show extensive necrotic changes. Such changes rarely are observed until after one hundred and twenty or more hours of generalized refrigeration have been given.

In general, no significant cell changes are observed in the nonneoplastic tissues of individuals subjected to generalized reduced body temperatures. However, certain physiologic functional disturbances of a systemic character have been observed. Their possible relationship to generalized refrigeration can be discussed, but no definite conclusions can be drawn.

The Useful Power Output of Short Wave Diathermy Apparatus

By E. Mittelmann, E.E., Ph.D., and H. J. Holmquest, B.S. in M.E. Quarterly Bull., Northwestern Univ. Med. School, 14:172, Fall Quarter, 1940.

In spite of the voluminous literature on the subject of short wave diathermy, it appears that the basic principles governing the absorption of power by a patient subjected to treatment are not thoroughly or generally understood.

It is obvious that to judge the heating power of a short wave diathermy generator, a knowledge of the maximum high frequency power which can actually be introduced into a patient by that generator is indispensable. The magnitude of this power determines the maximum power available from that generator for treatment purposes.

The total power delivered by a short wave diathermy generator is divided into two components, namely, the patient's power and the radiation losses. Both are subject to wide variation according to the technique of application, electrodes, air space, number of turns in the case of the induction cable, and the current flow and its frequency of oscillation. A determination of the amount of the absorbed energy is possible only if components of the total power output are separated.

The misleading use of the term "output power," meaning by this magnitude the total available output of a generator, has been and still is responsible for false conclusions as to the heating effectiveness of short wave diathermy generators. Various measurements indicate that the wattage used in clinical practice is relatively small in comparison with the output power.

The so-called output power of short wave diathermy generators is usually measured by lamp loads under optimal conditions. Such wattage determination gives no indication of the useful power, which is the power absorbed by the patient, because the conditions under which such measurements are made are entirely different from the actual electrical conditions which obtain during the treatment of a patient.

The thermal effectiveness, or the ratio which indicates how much of the maximum output available under optimal conditions can be converted into heat in actual treatment, depends only on the construction of the generator and the method of application. It is possible through proper design and technique of application to obtain a thermal effectiveness of nearly 100 per cent for a short wave diathermy machine, permitting the use of relatively low-powered oscillators. A properly designed generator having a maximum output of 200 watts will provide sufficient power even for fever therapy.

Measurement of the actual power absorbed by a patient is possible by means of a direct reading high frequency wattmeter.

Isolated Paralysis of the Serratus Anterior Muscle During the Puerperium

Leon S. McGoogan, M.D. In Amer. J. Obst. and Gynec., 40:2:313, August 1940.

The occurrence of an isolated paralysis of the serratus magnus muscle following generalized infections, exposure to cold or trauma to the long thoracic nerve is not uncommon. Horwitz and Tocantins state that over 150 cases have been reported. The paralysis is more common in men than women and is more frequent on the right than on the left side.

The treatment consists of muscle rest, preferably in a cast or splint, but if that cannot be done, support and rest in a sling. This should be reenforced with local heat and massage. The diet must be high in vitamin B content or supplemented with an adequate amount of thiamin chloride intramuscularly.

Electrical Convulsion Treatment of Mental Disorders

Abstract J. A. M. A., 115:15:1296, October 12, 1940.

To the editor:—In the editorial in THE JOURNAL, August 10, on "Electrical Convulsion Treatment of Mental Disorders," the only reference made concerning the technic is to the English article by Fleming. I should like to point out that the original technic, as utilized by Cerletti and Bini and as used in nearly all the clinics interested in the method, can be found in the English paper by McGregor and Shepley, BRITISH MEDICAL JOURNAL, Dec. 30, 1939, page 1269. These English workers first explained in detail the original technic. Fleming and his co-workers in their paper describe a technic differing from the original technic in various points. In particular, they do not utilize the special electrodes which allow the application of a lower current intensity and a diminished time of passage of current necessary for the production of a seizure.

At the New York State Psychiatric Institute and Hospital, Dr. Kalinowsky and I have adhered closely to the original technic. We have been in constant touch with numerous clinics throughout the world engaged in this type of therapeutic procedure and from personal communications with these clinics we are able to say that several thousands of convulsions already have been produced with this method. It was just in light

of the simplicity, the harmlessness and the effectiveness of the original method that we refrained from making any essential changes in the method. We also wish to recommend to American psychiatrists, with this original method a simple technic which does not necessitate special knowledge of electrology and which may become a practical and useful routine treatment in psychiatric procedures.

The Therapy of the Cook County Hospital

The Therapy of Acute Delirium (Toxic Psychosis, Fever Psychosis, Inanition Psychosis).

Edited by Bernard Fantus, M.D., in collaboration with S. H. Kraines, M.D. In J. A. M. A., 115:11:929, September 14, 1940.

Protection—In all those conditions in which delirium is likely to occur, as in every alcoholic addict who is starving from the exclusive use of liquor, from vomiting or from intercurrent disease, the physician should look for tremor, reflex disturbances, changes in the patient's mental grasp and orientation, and in his feelings and sensations. The forerunners of delirium are continued insomnia, taciturnity and apathy or loquacity and nervous irritability, suspiciousness, anxiety and muscle twitching. When any of these are discovered and even in the absence of hallucinations or delusions he should promptly institute appropriate measures to keep the patient from harming himself or those around him.

Hydrotherapy is of great value, especially for the alcoholic addict. The secret of its success lies not only in the specific soothing and relaxing effect of the warm water, but also in the fact that the patient is comfortable while in the bath and uncomfortably chilly the moment he tries to get out of it. Sometimes an ordinary tub bath of warm (not hot) water (never over 100 F.) for half an hour will work wonders in quieting a patient. Still better is the prolonged or continuous neutral bath with water between 96 F. if there is fever and 98 F. if there is no fever. The temperature of the water always should be a little lower than the body temperature to allow for the escape of heat from the body. These tub baths should be tried as a rule before giving sedative medication, if the condition of the patient, for example, surgical wounds, does not contraindicate it. The medicinal sedatives are substances foreign to the human body not entering into its anabolic processes. They are poisons which must be eliminated by the emunctories overstrained by the poisons already present. Often medication actually aggravates the delirium. In properly equipped "continuous bath" tubs it is possible to keep a patient for eight hours or longer. In such baths the temperature must be constantly checked and recorded so as to avoid chilling or scalding. While the patient is in the tub he should have an ice bag on his head and be given frequent sips of water. The room should be darkened, warm and quiet.

Another useful form of hydrotherapy is the "cold wet pack." The patient is placed on a table and wrapped in a sheet which has just been wrung out in water of about 65 F. and immediately afterward wrapped in warm blankets outside the sheet. The sheet will absorb much of the body temperature and the reacting warmth often has a strong soothing effect. The covering blanket may be retained after half an hour or removed, always depending, as in everything else, on the thermic and circulation reaction of the patient.

Short Wave Diathermy

Lee De Forest, Ph.D., Sc.D. In Military Surg., 87:4:330, October 1940.

The regulation of doses in medical diathermy is empirical. In short wave diathermy the only recognized method of measuring doses is the comfortable sensation of the patient's skin. The high-frequency indicating milliammeter does not measure the electrical energy actually passing through the patient. The patient's tolerance is the most important guide for the final dose to be used.

In application of short wave diathermy there should be no clothing between the electrodes and the skin. After the treatment it is important to inspect the skin of the part treated.

In the design of an efficient radio diathermy emitter certain fundamentals of good design should be kept in mind. The chosen optimum frequency should be held constant. Further there should be no pronounced harmonics or multiples of the fundamental frequency. To accomplish this frequency stability the oscillatory circuit must be most carefully designed, and the method of coupling the output circuit must be employed which will prevent any great frequency change by variation in the tuning of this circuit, either by change in radio-frequency intensity or by placement of the external condenser electrodes or applicators. It is important that all practical means for reducing interference with radio signalling should be embodied in the design of radio therapy apparatus.

To obtain equal irradiation from both applicators, an exceedingly valuable advantage in practice, current stability is paramount. Unipolar treatment, using only one applicator on the body,

the other connected but lying idle on a table, is perfectly feasible and is recommended where a minimum of irradiation is desired. One large and one small applicator may be used if desired.

A continuous radio-frequency output must be had, with continuous heating effect, if an immediate temperature equilibrium is to be reached in the tissues.

Notwithstanding what has here been said regarding the reliability of the properly designed radio-diathermy emitter and the simplicity of its modes of application, success in treatment with this modality by no means results from haphazard technic. Only by careful study of each individual situation, notably as regards the location of the applicator pads, their distance from the flesh, the dosage, the duration of treatment, the strict avoidance of unnecessary heat effects, of point burns due to accumulation of sweat layers beneath the application pads—can be attained the brilliant results which ordinarily attend radio-diathermy when properly applied. This truism cannot be too strongly emphasized.

No better, more clearly expressed rules for applying radio-diathermy have been stated than the following, presented by Dr. Kobak as a result of his careful and painstaking use of this modern modality during an extended period of time: (abbreviated from Arch. P. T., January 14, 1935):

1. Considering that in radiothermy the sensitivity of the patient to warmth is the sole reliable guide to the regulation of dosage, it is essential to examine each patient for normal sensitivity to heat and cold, to exclude the presence of affections of the nervous system which are characterized by loss of sensitivity, and to avoid the danger of producing burns.

2. Each patient should be advised that the treatment must produce only moderate and pleasant warmth, and that the moment sensations of intense heat of a painful nature are experienced, he should report it, to allow adjustment.

3. All metallic substances and objects within the field of treatment must be removed before treatment, to avoid intense localized heating and burns.

4. Care must be taken when treating regions in which the bones lie close under the skin. Here the patients may complain of painful sensations instead of experiencing the pleasant warmth essential for success with radiothermy. This is well known as periosteal pain. It is essential at once to switch off the apparatus and to await complete cessation of the unpleasant phenomena, after which treatment may be resumed with moderate dosage.

5. Oil cloth, art leather, old rubber mats and any moist substance, all of which are so-called semiconductors, should not be employed as pads under any circumstances, not even with covering of nonconducting material. The principal reason is that semiconducting materials may become overheated and otherwise act like metal apart from deviating energy, which in turn would nullify the effects of treatment.

6. To secure the proper depth effect, the distance between the electrodes and the skin should be not less than one, and frequently as wide as 20, centimeters (depending upon the power available from the emitter employed), the variation depending on the size of the electrode and make of apparatus. As a rule the larger the electrode, the greater should be its distance from the skin.

7. All-felt pads used to produce separation of electrodes from the skin must be absolutely dry not only before but throughout the treatment. To avoid these pads becoming moistened by the patient's perspiration, blotting paper or some cellular material, linen or similar material such as cotto-cellulose must be interposed between the skin and the felt pad.

8. As burns are more likely to appear where osseous structures lie close to the skin or where one encounters irregularities of contours, such as prominences in articulations, one should in all such places insure against such an accident by increasing the skin-electrode distance. Similarly one should not increase without control the dosage simply because patients state that they no longer feel warmth. As was pointed out, patients become dulled to the sense of heat, and an unnecessary increase of dosage may lead to burns. In all such cases, the resonance-indicator is of relative value as a guide.

9. In the application of shorter wave lengths the physician should exercise special control and watchfulness, as one must not rely solely on the sensitivity of the skin to heat. Impairment of sensitivity even to a slight degree always is to be borne in mind. Undesirable complications are avoidable by care.

10. In all cases affecting the head, especially when involving also the brain, individual reactions must be observed. Not infrequently patients complain of headache, dizziness or other nervous phenomena, which dictate the usual precautions.

11. In applications of radiothermy to patients suffering from heart disease, the same precautions must be taken as with any form of heat therapy, including diathermy. Watching the pulse will guard against mishaps.

The Penetrative Effect of Cold

William Bierman, M.D., and Mae Friedlander, Ph.D. In Arch. P. T., Oct. 1940.

Cold applied to the skin and mucous membrane surfaces of the living human body can cause a substantial diminution of the temperature of tissues lying a considerable distance beneath these surfaces. The extent of the influence in distance and in temperature depends upon the nature of the substance applied, its variation from thermal neutrality (i.e., the temperature of the body surface), the duration of its application and the region upon which it is placed. Water is a convenient vehicle because of its capacity for absorbing heat (twenty-seven times greater than air) and its availability at low temperatures.

Cold Applied to the Human Leg.—Following the placing of an ice bag on each side of the human calf the calf muscle temperature was diminished as much as 26.4 F. The blowing of cold air on the living human calf also caused a lowering in intramuscular temperature though to a far less degree than did the ice bag. Alcohol poured on the skin surface diminished the subcutaneous temperature about 3 F. It did not influence the intramuscular temperature.

Cold Applied to Cheek.—A flat hollow metal applicator kept cold by circulating water through it (temperature 50-52 F.) was placed on the outer side of the cheek. The temperature of the inner side of the cheek in the corresponding area was measured by an alcohol thermometer, with the lower portion of its stem bent at a right angle so as to permit good contact between its circular flattened base and the buccal mucosa. At the end of 32 minutes, the temperature fell from 95 F. to 85.5 F.

Cold Applied to Rectum.—When cold water was circulated through a hollow metal applicator inserted in the rectum, the posterior urethral temperatures were determined by a thermocouple (made of iron-constantan) with its tip protruding through an opening at the end of a silk woven catheter. The catheter was pushed beyond the cut-off muscle. The thermocouple was permitted to remain in the posterior urethra during the course of the experiment. The greatest fall in urethral temperature was 23.8 F.

Cold Applied to the Vagina—A hollow metal cylindrical applicator was inserted into the vagina. It was cooled by circulating water through it. The temperature of the vaginal applicator and the changes produced within the rectum and urethra were determined by mercury thermometers. During 50 minutes the urethral temperature diminished from 99.2 F. to 91 F.

Progressive Relaxation in the Treatment of Pulmonary Tuberculosis

Eugene F. Traut. In Amer. Rev. Tuber., XLII; 3:420, September 1940.

Present-day treatment of tuberculosis is rest. General and pulmonary rest are hindered by irritability. This toxic "restlessness contributes to cough, insomnia and hyperperistalsis."

Prescribed rest often fails because the patient does not know how to rest. Told to relax he says he cannot. He may be in bed, or indeed asleep and yet not resting. He may deny that he is restless, offering as evidence his facility in going to sleep and remaining asleep. And yet asleep he twitches, turns, talks or dreams violently and awakens more tired than on going to bed.

Jacobson has proved that muscular contraction including tonus can be prevented or stopped by simply desiring not to contract muscles. James long ago proved that every emotion or even each thought had its physical counterpart in muscular contraction. Using this idea, Jacobson has shown that doing away with this physical expression of mental activity obviates the responsible cerebral function. According to Jacobson inhibition is a negative process, absence of muscular activity. He has devised a method of teaching the tense patient to reproduce and appreciate tensions in the various muscle groups and again to relax them. An intelligent individual can relax to the point of abolition of tendon reflexes. This represents the closest approach to basal conditions, ideal or absolute rest.

Methods of Resuscitation

Ralph M. Waters, M.D. In J. Labor. and Clinical Med., 26:1:272, October 1940.

"Resuscitation" is not the resurrection of the dead, but the reestablishment of oxygen transport from atmosphere to body tissues when either factor in that transport has been interrupted suddenly.

The restoration of circulation, once is ceases, rarely is possible. Treatment directed at the heart and blood vessels other than the injection of blood and other fluids is indicated only in unusual circumstances.

The most logical procedure in emergencies demanding resuscitation is the provision of (a) a free and unobstructed airway and (b) intermittent exchange of alveolar atmosphere containing excess oxygen.

Mechanical devices rarely will be needed if instant intelligent aid is at hand. They do not produce more adequate exchange than direct inflation from the operator's own lungs or manual maneuvers, nor higher concentration of oxygen

than a simple oxygen cylinder, breathing bag and mask, and they may overventilate or traumatize the lungs. Their sole advantage is seen in cases requiring long periods of artificial respiration, such as drug poisoning, paralyses, and the like, when the operator might become exhausted. Rarely will such cases come under the classification of "resuscitation."

Finally, the reestablishment of the physiologic functions which transport oxygen is within the physician's province. The fact that some physicians even in hospital practice are dependent on lay rescue squads is a reflection on medical education.

The Treatment of the Cerebral Palsies

Winthrop M. Phelps, M.D. In J. Bone and J. Surg., 22:4:1004, October 1940.

The studies of etiology have shown that many factors, which are entirely beyond the control of the obstetricians, enter into birth injury, and that really poor obstetrics will account for only a very small number of cases. However, cerebral palsy seems mainly a human condition, since its occurrence in any of the animals, even the anthropoids, is exceedingly rare.

Athetosis is characterized by involuntary motion, so that interference with an attempt to move is never predictable to the patient. Athetosis is a basilar or non-pyramidal-tract condition and the type in which true mental defect is not likely to occur. Athetosis is not well-suited to muscle examination since the motions are total joint "attempts" and will persist with what muscles are left even if some are cut, neurectomized or transplanted. Consequently, athetosis is not improved by peripheral surgery (at least as we know it now), except for the correction of true contractures.

Spasticity. In conservative treatment, the flaccid muscles and weak muscles must be protected from the weakening effect of undue stretching, and the spastic muscles must be protected from the strengthening effect of the stretch reflex. With treatment by selective massage and careful exercise with appropriate splinting and protection, a great change in muscle balance may be attained. The amount of surgery apparently necessary at first will be greatly diminished.

Athetosis. Surgery of the muscles, nerves or tendons, therefore, has very little effect. Joint stabilizations are exceedingly difficult in athetosis because it is almost impossible to maintain enough fixation for good fusion. The discomfort of the patient following the operation is very great and there is much difficulty with pressure sores. In general, surgery is unsuccessful. In severe cases Putnam's procedure of lateral cord section is helpful but it serves more to quiet the athetosis than to increase function. The use of curare, as described by Burman, is still definitely experimental but its further development should be watched with interest.

Relaxation, taught by a carefully graded system, beginning with the least athetoid parts of the body and, when learned, extended to the more athetoid extremities, is, over a long period of time, very effective. This, combined with motion from the relaxed position, is the most effective form of treatment and eventually brings about very satisfactory results.

Ataxia. The treatment of this condition is simply that of training the voluntary motor centers to take over the function of the damaged balance mechanism. It can be compared to the learning of any other skill, such as playing the piano. At first, all the attention must be fixed on the skill being learned, but later it can be carried out almost without thought. Thus, with sufficient practice, the skill of balance and directional control can be learned in a similar manner and eventually becomes habitual.

The author gives the following:

1. Cerebral palsy, representing about seven births per 100,000 population per year, presents a real problem with regard to the number of cases.

2. Mental level is sufficiently high in about 70 per cent of the total to make treatment worthwhile.

3. The incidence of the condition, unlike epidemic poliomyelitis, is at present entirely predictable, and plans can be made in advance for treatment of a definite number of cases.

4. The importance, with regard to treatment, of accurate diagnosis of spastic, athetoid and ataxic palsy, must be emphasized even though differential diagnosis occasionally is very difficult.

5. The present use of surgery is essentially limited to the true spastic, except for contractures.

6. The most effective method of treatment is the special school where physical reeducation and schooling can be carried out together.

7. There must be close cooperation and mutual understanding of the problem among the educators, the physicians and the family of the patient.

8. Home training is, in some instances, very effective, and, in most cases, should at least be given a trial of several months before deciding on the special school.

9. Satisfactory results, judged by the standards of other crippling conditions, are obtained when care and treatment are sufficiently intensive.

Physical Therapy in the Military Service

John S. Coulter, M.D. In J. A. M. A., 115:10:864, September 7, 1940.

In the communications zone the most important hospital unit is the general hospital. In a communications zone with six field armies in the theater of operations there would be authorized 300 general hospitals for the communications zone. The number of general hospitals allotted to the communications zone would depend on the location of the communications zone in relation to the zone of the interior, the extent of the zone and the number of troops involved. Under certain conditions there may be no need for general hospitals in the communications zone, while under other conditions, such as with an oversea expeditionary force, a large number may be required.

The general hospital is a fixed unit of 1,000 beds capacity, designed for the treatment of all cases arising within the theater of operations and located a sufficient distance from the combat zone so that military reverses will not disturb their operation. Its equipment is adequate for the care of all cases of whatever severity.

General hospitals should be located at points which afford good rail or water connections with regulating stations and with the zone of the interior. The presence of suitable buildings and utilities is most advantageous, but additional construction usually will be required. In planning construction consideration should be given to the availability of nearby landing fields for airplane ambulances.

As the equipment of a general hospital should be adequate for the cure of all cases of whatever nature or severity, it is here that physical therapy should be started in the care of many fractures, dislocations, wounds and amputations. In individuals suffering from trauma, physical therapy is most effective if started early in the general hospitals of the zone of communications and continued in the general hospitals of the zone of the interior. In the First World War physical therapy was started in the general hospitals and hospital centers of the army of the United States in France and was most effective in reducing the length of temporary disability and the amount of permanent disability.

In any event an estimate of 300 general hospitals of 1,000 beds each for six field armies in a war of such severity as is occuring in Europe would not seem to be excessive. Proportionately, in comparison with civil hospitals with the same number of beds an army general hospital physical therapy department will need a medical director and at least six physical therapy technicians.

Hysterical Contractures Following War Injuries

Foreign Letters—London (From our Regular Correspondent), Aug. 17, 1940. Abstract J. A. M. A., 115:13:1113, September 28, 1940.

At the Royal Society of Medicine, Sir Arthur Hurst opened a discussion on hysterical contractures following war injuries. In civil life contractures following injuries were comparatively rare but after war injuries were frequent. During the last war the nature of these contractures was much discussed but only toward the end did it become almost universally recognized that they were hysterical and could be quickly cured by proper treatment. The most common contracture followed injury to the soft parts of any type. Sometimes there was no wound, only a twist or a sprain.

Treatment in the early days of the war consisted in a certain amount of suggestion and occasional hypnotism, but later Hurst and his colleagues found simpler methods of psychotherapy more valuable. The patients were not commonly hysterical and never had had "shell shock." Persuasion, manipulation and reeducation were found effective and the ideal patient was cured merely by telling him what to do.

In the discussion Dr. J. B. Mennell (physical therapist) said that if there was one condition more than another with which the physical therapist should not interfere it was these contractures. Unraveling them by force was a barbarous method and the contractures recurred.

Active Muscle Usage in the Treatment of Fractures

Otho C. Hudson, M.D., F.A.C.S. In Amer. J. Surg., XLIX:2:219, August 1940.

In the treatment of fractures, proper reduction of the lesion, immobilization until union occurs and restoration of the function of the extremity are recognized necessities. It also is generally accepted that the optimum time for reduction of a fracture is as soon as possible after the accident. At this time contractures are not present, the tissues are not indurated and swelling is not extensive.

We were taught in school to immobilize a fracture and to keep the muscles quiet. This treatment quickly leads to stiff joints, swelling of the extremity and a convalescence prolonged long after the bony injury has healed. This teaching is fallacious. During the entire time of immobilization of the fracture, active motion of all joints not immobilized and muscle contraction of those beneath the fixation dressing prevent joint stiffness and swelling.

To secure active joint motion of unimmobilized points the fracture must be adequately fixed so as not to cause pain. If this is not done any attempt to move the joints causes pain and muscle spasm, and no motion occurs.

Every patient should actively move joints which are not immobilized and contract the muscles under the dressings from ten to twenty times or for ten minutes every hour on the hour during the entire waking day beginning the day of the injury and continuing until the fracture is healed. This simple rule will prevent these stiff joints and swollen extremities that take months to rehabilitate.

The Medical and Social Approaches to the Problem of Chronic Rheumatism

Robert B. Osgood, M.D., D.Sc. In Amer. J. Med. Sci., 200:4:429, October 1940.

Therapeutic Trends. Generalized disease: One therapeutic trend overshadows, we may say dominates, all others. It is based on the conviction that chronic rheumatism is a generalized disease analogous to lues, tuberculosis, "Bright's disease." It is not a disease of the joints per se, although the joints become diseased.

1. GENERAL MEASURES. *Early Recognition.* Successful therapy demands early recognition and early treatment.

Team Play. We emphasize the importance of "team play." A competent and interested internist is the first essential.

Rest. Rest of the body and mind is another essential. This does not mean inactivity, indeed it often means more exercise in order to conserve joint function and avoid emotional strain.

Body Mechanics. I must give testimony to the faith that is in me with a few words on the subject of body mechanics as a universally applicable method of the general treatment of a generalized disease. No sculptor or painter ever successfully portrayed a healthy or efficient person who did not exhibit in either activity or repose good body mechanics, or a weak depressed person who did not exhibit faulty posture. William James, the psychologist, once said that the erect posture exerted an important effect upon the emotions. We might have expected this great student of the mind to have said that the emotions exert great influence upon posture, which is to some extent true, but he did not. If we see to it that our rheumatic patients lie and sit and walk in such a manner that the great systems of the body, respiratory, gastro-intestinal, muscular and skeletal, may function with the smallest amount of mechanical restriction, we shall remove one of the most serious handicaps to their physical and emotional betterment.

2. SPECIFIC MEASURES. *Diet.* There is no standard diet for chronic rheumatism.

Vaccines and Sera. The widely accepted theory of focal infection as an important etiologic factor has led to the common employment of vaccine therapy. End-result studies have been disturbingly confusing.

Drugs. Since we have no specific drug for chronic rheumatism we may group the ones in most common use under the old-fashioned headings of sedatives, analgesics, vasodilators and certain drugs which are thought to be useful but the exact action of which we do not know, for example, sulphur and the salts of gold.

Climate. Holbrook's study of the incidence of chronic rheumatism among the population of the high and dry Arizona Desert and of some of the western Indian tribes suggests that we must accept the fact that elevation and dryness and sun exert at least a strongly inhibiting influence upon the incidence of atrophic or rheumatoid arthritis.

Physical Therapy. This is perhaps the oldest of the rheumatic "cures." It remains a powerful arrow in the quiver of therapy. I am convinced that it should be planned and supervised and frequently checked, not by a physical therapy technician but by the captain of the patient's fate himself. Otherwise grievous sins may be committed in its name.

Observations On Prolonged Human Refrigeration

Temple Fay, M.D., F.A.C.S. In New York State J. Med., 40:18:1351, September 15, 1940.

The first observations in general refrigeration in the human being (so far as is known) are presented.

Human body temperature can be repeatedly and successfully reduced to around 80 F. (rectal), and the patient observed for many hours (up to 8 days) without subsequent abnormal effects.

In terminal cases of generalized carcinomatosis, death from cerebral edema and cardiac failure was noted in approximately 15 per cent during or following generalized refrigeration.

Temporary and prolonged periods of relief of pain were noted in almost every instance. Withdrawal of narcotics was therefore possible.

No definite regressive changes in undifferentiated cell growth were noted in deep metastatic lesions following generalized refrigeration. Temporary improvement frequently occurred.

Physical Medicine in Industry and War

Prof. Gunzburg, Antwerp, President of the International Association of Physical Medicine. This article was received immediately before the German occupation of Belgium. In Brit. J. Phys. Med., 3:9:168, September 1940.

With regard to organizing physical therapy so that its benefits can be most effectively applied in war-time, the following suggestions are made: In the first place physical medicine should be under some general control which should make available all types of modern equipment in sufficient quantity. From this controlling organization information would be sent to the big hospitals, ensuring that the patients obtained the best type of treatment. On the other hand, small mobile physical therapy units should accompany the surgical units to the front, so as to provide immediate treatment.

In the base hospitals there should be laboratories and control centers with all the necessary apparatus for giving functional treatment, ergometers, apparatus for electrodiagnosis, for respiratory sampling, for noting fatigue curves, for measuring the metabolism and for complete biometry, absence of which facilities renders physical medicine a body without a soul.

With regard to physical therapy treatment it would take too long to enumerate all the methods that can be employed with advantage and all the indications for their use.

The following suggestions, however, are important:

1. Immediate physical therapy measures to prevent complications. For the warming-up of limbs and the prevention of infection portable infrared lamps are essential. Oxygen-therapy apparatus also is useful, from the simplest inhalation mask to the iron lung.

2. In the operation room, short-wave apparatus is invaluable; it enables the surgeon to warm up the wounded man before operating, and even those that await their turn for operation. In the case of abdominal injuries, hypothermia is an important danger not to be neglected. Bordier showed the importance of diathermy in such cases. There should be available a few Wood-lamps for the examination of the wounds and for sterilization in abdominal operations as described by Havlicek. Electro-magnets, combined with radiography, should be employed for extraction of metal fragments from the eye or other tissues.

3. Behind the front lines the equipment can be more complete. If used by capable persons, galvanic and diathermy apparatus as well as ultraviolet lamps will render valuable service.

As soon as possible, however, the wounded should be removed to a place where mechanotherapy, massage and reeducation are available.

4. Finally, the convalescent should be sent to the ergotherapy center where he will carry out the type of occupational therapy suggested above. But, as the men who require functional reeducation are soldiers, more energetic ergotherapy should be undertaken, such as leather and iron work, basket-work, and even work such as digging.

The Treatment of Common Diseases of the Skin

Louis A. Brunsting, M.D. In Journal Lancet, LX, 10:438, October 1940.

Winter Itch, Asteatosis, Bath Pruritus

Itching commonly occurs among those who have a dry, harsh skin when the natural dryness is aggravated by cold weather, contact with wool, the use of hard water or the too frequent application of soap in bathing. Careful examination of the skin in such cases will reveal a condition of microscopic chapping. This situation obtains frequently among patients in hospitals, where a daily bath and alcohol rub are routine procedures, and if itching develops, more alcohol is used or drying lotions of the calamine type are prescribed. Such persons need to revert to the good old-fashioned American institution of the Saturday-night bath. It is better, if there is distress and beginning dermatitis, to eliminate the use of soap, to immerse the patient for twenty to thirty minutes daily in a mildly alkaline tepid bath to which cornstarch or bran or boiled oatmeal has been added. Directions for the oatmeal-soda bath follow:

Oatmeal-soda bath. Thoroughly cook two cups of bulk oatmeal in 1 quart of boiling water for thirty to forty-five minutes in a double boiler. Allow to cool for fifteen minutes, then add half a cup of baking soda. Pour the entire mixture into a gauze bag and tie shut. Place in a bath tub a half to three-fourths full of water at 90 to 96 F. The patient may stay in the tub for one-half to two hours, expressing the oatmeal mash through the gauze and applying it to the body. The mash should be washed off thoroughly before leaving the tub and the patient dried by patting, not by rubbing.

After the bath and as often thereafter as needed, the entire skin is annointed with a soothing lotion such as a well-shaken mixture of equal parts of olive oil and lime water.

Further Observations on the Treatment of Bursitis of the Shoulder

Robert Lee Patterson, Jr., M.D., and Russel H. Patterson, M.D. In Amer. J. Surg., September 1940.

The author states:

1. The most common condition found in the painful shoulder is bursitis.

2. Primary bacterial inflammation is rare in subacromial bursae.

3. Subacromial bursitis is nearly always secondary to injury of a neighboring structure.

4. Calcification can be demonstrated in about four out of five cases of bursitis of the shoulder.

5. Calcification in the five main tendons about the shoulder may eventually occur if they have been subjected to wear and tear or repeated small injuries.

6. The severity of the symptoms associated with bursitis is not in proportion to the amount of calcification present.

7. No treatment of a painful shoulder should be undertaken until x-rays have been studied. The oblique projection is strongly recommended.

8. Irrigation of the bursa is indicated in a large majority of acute cases. It is, however, definitely contraindicated in periarticular inflammation and all conditions of doubtful etiology.

There is a large group of cases classified as periarticular inflammation, second in frequency in our series, which require an entirely different form of treatment. These patients are not usually seen by the specialist in the acute stages but are referred to him after the shoulder has failed to respond to all the routine forms of treatment—baking, massage, diathemy plaster, injection.

Because the patient is sick, has a lowered resistance and is physically tired of both pain and disability, it is imperative that all form of treatment be discontinued for a period of two weeks or longer. A vacation or rest from work is indicated. After this the following routine is recommended:

1. A complete physical examination with the removal of all possible foci of infection should be made and proper medication for sleep, diet or anemia given.

2. The patient should be told that the process is a long one, often lasting four to six months, that perseverance is necessary, but that the results will be good with proper treatment.

3. Antigravity exercises should be performed regularly and efficiently each day.

4. Failure to respond to exercise after one month of treatment is an indication for admission to a hospital, where manipulation with breaking of adhesions should be performed. At the suggestion of Ober we have injected the bursal region with 150 to 200 c.c. of saline and then manipulated the joint. This technique tends to dilute hemorrhage and to prevent the reforming of adhesions. We have tried it in a small number of cases and have found it to be of value. An abduction splint should be applied immediately and kept on for a period of three weeks. It should be removed daily, however, for exercise. In the average case, unless splinting is done following this treatment, the joint will very quickly "freeze" again.

The Crippled Child

Archer O'Reilly, M.D. In J. Mo. State Med. Assoc., 37:8:346, August 1940.

Orthopedic treatment is the first and most important step in a plan of rehabilitation for the crippled child because careful medical care is essential to restore the patient to as nearly normal a condition as possible. The nearer normal the patient, the easier are the other parts of the program.

Orthopedic care of the crippled child should begin immediately after the onset of the condition. Correction of congenital deformities should be begun immediately after birth. In most cases early treatment means hospitalization. The treatment of tuberculosis of the joints and other diseases means rest and support, often for many months. Infantile paralysis also may mean months of rest in bed.

Occupational therapy is a valuable adjunct in the treatment of orthopedic cases. It is not a panacea and will not give motion to joints that are ankylosed nor give power to muscles that are completely paralyzed. In the early stages it supplies work and amusement to the bedridden, and, by alleviating the stay in bed, makes the patient easier to treat. Later occupational therapy, by making work and exercise interesting, is able to secure more rapid results. Occupational therapy is what its name implies, a treatment by occupation. It never should become commercial. When one begins to produce salable objects the therapy angle disappears. In the later stages, occupational therapy can be used as a step to prevocational training.

Orthopedic surgery, however, is not negative. There are numerous steps that can be taken to increase the use and function of joints and muscles. Stiff joints under certain conditions can be mobilized by arthroplasties.

The Therapy of Rickets

Edwards A. Park, M.D. In J. A. M. A., 115:5: 370, August 3, 1940.

Rickets can be prevented and cured in two ways: by irradiation of the skin with ultraviolet rays and by ingestion of vitamin D.

Both intensity and time factors are concerned with the therapeutic effect of ultraviolet light in rickets. For example, a long exposure to ultraviolet light when little exists may be the equivalent of a short one under more favorable conditions. Clark estimated that in Toronto exposure of approximately twenty minutes to the noon sun in June was equivalent to three or four hours in January.

As stands to reason, the exposure of the entire body or large parts is more effective than the exposure of a small part. It is important to realize, however, that the exposure of the arm alone in a case of rickets is sufficient to cause a general deposition of lime salts (Huldschinsky).

Pigmentation of the skin is nature's method of protecting the dermis. Irradiation if sufficiently intense and prolonged will cause ulceration of the deeper layers if all pigment is lacking. However, the horny layer of the epidermis is a defense against ultraviolet light since it absorbs the ultraviolet rays. "The pigment layer is the sunshade for the dermis as the horny layer is the sunshade for the epidermis." Radiation is curative of rickets in the Negro in spite of the heavy pigmentation. This indicates the superficiality of the seat of action of ultraviolet light. Ultraviolet light can penetrate the living skin of the rabbit a distance of from 1 to 2 mm.

Window glass removes all radiations shorter than 315 millimicrons. Behind window glass, therefore, sunlight, no matter how rich in active rays, will not exert any antirachitic effect. A variety of substitutes for window glass have been developed, some of which transmit 50 per cent or more of the antirachitic radiations. In an ordinary room, as an object is moved farther and farther from a window, the area of sky becomes so small that the quantity of reflected rays which can reach the object become virtually nil. Unless an infant, therefore, is placed, practically speaking, against the window itself, he cannot benefit from the reflected rays. The only rays to penetrate the interior of the room through the special glasses are the direct rays. Even if the exposure is the most favorable, the direct rays shine in only for a fraction of the day in a continually shifting shaft of light. Only if a room was constructed entirely of the special glass and placed where the view was open, for example, on the top of a high building, so that the sky shine could enter from all sides, would the special glass have a considerable usefulness, but in winter it would have very little even so.

The artificial sources of ultraviolet light are the quartz mercury-vapor lamp and the carbon arc lamp, both far richer than the sun's rays. The quartz mercury-vapor lamp gives off an emission of infra-red (52 per cent) comparable to that in solar radiation, a much smaller percentage of visible light (33 per cent) and a wealth of ultraviolet light of wavelengths ranging from 310 to 250 millimicrons. Twenty-eight per cent of the total energy lies in the ultraviolet and 6 per cent in wavelengths shorter than 290 millimicrons, the extreme limit of the solar spectrum. The spectrum of the quartz mercury-vapor lamp is discontinuous, though this feature is not a detriment.

The quartz mercury-vapor lamp and the carbon arc lamp may be used to supplement administration of vitamin D. When the carbon arc lamps are used, a curative effect may be obtained even though no tanning is produced. The quartz mercury-vapor lamps cause tanning. Tanning is a useful sign that ultraviolet light is producing an antirachitic action. Obviously, the use of the quartz mercury-vapor lamp and of the carbon arc lamp is contraindicated in blonds who "burn" and do not tan. For such individuals it is better to rely on the administration of vitamin D.

The Influence of Hot and Cold Application Upon Gastric and Intestinal Motor Activity

J. Dewey Bisgard, M.D., and Dan Nye, M.D. In Surg., Gynec. and Obst., 71:2:172, August 1940.

Conclusions

1. Gastro-intestinal motor activity is inhibited by the application of heat to the abdominal wall and by iced water taken by mouth. It is stimulated by the application of ice to the abdominal wall and by the ingestion of hot water by mouth.

2. External cold applications increase gastric acidity, increasing both free and total acids. In a subsequent publication it will be proposed that this response be utilized in the test for true achlorhydria. By simply immersing the hands in iced water for a few minutes a response similar to that resulting from the subcutaneous injection of histamine can be obtained.

3. The ingestion of iced water diminishes the secretion of acids by the stomach.

Low Back Pain: Backalgia

Eugene L. Jewett, M. D. In J. Florida Med. Assoc., 27:2:89, August 1940.

1. Probably the most common cause or contributing cause to low back pain is poor posture with or without overweight. In these cases we see the rounded shoulders, the forward protuberance of the head and abdomen, the exaggerated lumbar lordosis, pronated painful feet and ankles. The treatment for this complex syndrome is difficult and depends to a large extent on the intelligence and cooperation of the patient, his age, general health and the type of his work or stage in life. In *Body Mechanics* by Drs. Goldthwaite, Brown, Swain and Kuhns you will find an excellent treatise on these conditions. The average practitioner, however, cannot carry out such a detailed exacting regime of treatment and will have to depend on a less elaborate armamentarium. The weight can be taken off by dieting and exercises, and the posture is possible of improvement through constant attention of the parents and friends and frequent checkups by the physician in charge. Repeated strapping of the back, the wearing of sacro-iliac and lumbosacral supports and, in some cases, lumbodorsal supports, with occasionally the use of one of the various rigid supports, will be of great benefit to the patient.

The feet may have to be manipulated and supported by proper shoes and arches, with or without lifts to correct faulty weight bearing lines.

Abdominal and back exercises are important for these poor posture cases but should be gradually increased and not made too hard for the weakened musculature. In between the regular exercises some sort of support may have to be worn. The physician or trained physical therapist should carefully instruct the patient as regards his exercising and should see him at regular intervals. Often golf, tennis or swimming may help, with the latter being probably the best all around developer that we have in the field of sports. A business man usually will use a stationary machine or row a boat but will not engage in just exercising. If there is a gymnasium class in the community, this is generally a good thing to have him join. Physical therapy measures often will help—at least symptomatically. A hard mattress is a great help to most of the patients.

2. Patients with acute direct and indirect trauma should have their backs supported or strapped, with rest in bed until the acute symtoms have subsided and healing has begun. These conditions will need more extensive physical therapy with diathermy heading the list, combined with manipulations and probably novacain injections.

3. The painful back from myofascitis or fibrositis, whether it be from a recognizable focus of infection or not, presents a somewhat similar picture to the one of trauma. With the subsidence of the acute symptoms the same general treatment should be carried out as given above for traumatic cases. Often, however, the clearing up of a focus will lead to a subsidence of the back pain in short order. In these chronic cases novacain injections into the involved areas will every now and then produce a startling result, which may be permanent.

4. When we find a neuritis or neuralgia from a focus of infection the patient is best treated in bed with or without Buck's extension on the lower extremities until the focus is cleared up. These people usually feel better with the thighs and knees somewhat flexed and at times with a small pad beneath the lumbar spine. In many cases, however, sciatica really is secondary to sacro-iliac or lumbosacral conditions and clears up with adequate therapy to these regions.

5. The treatment of arthritis of the joints in the lumbosacral region depends largely on the type of arthritis present.

6. The various abnormalities of the spine and pelvis if not very pronounced generally respond to physical therapy, exercises, rest and supports.

Common Vesicular Lesions of the Hands and Feet: Diagnosis and Treatment

C. Barrett Kennedy, M. D. In Southern Med. J., 33:10:1036, October 1940.

The danger of overtreatment of vesicular lesions is too well known to need extended discussion at this time. It is our practice to employ bland medications and to use the following routine in all cases, whether or not evidence of infection is present:

(1) Hot compresses.

(2) Local applications of 1 to 2 per cent aqueous solutions of gentian violet during the day.

(3) Local applications of 5 per cent ichthyol ointment at bedtime.

(4) Ultraviolet light in small amounts daily.

(5) Sulfanilamide in 5 grain doses three times a day.

Persistence in the use of these simple measures has given us very satisfactory results in these common and frequently stubborn types of dermatoses.

Book Reviews

THE FOOT AND ANKLE: THEIR INJURIES, DISEASES, DEFORMITIES AND DISABILITIES. By Philip Lewin, M. D., F.A.C.S., Associate Professor of Bone and Joint Surgery, Northwestern University Medical School, Chicago; Professor of Orthopedic Surgery, Post-graduate Medical School of Cook County Hospital; Attending Orthopedic Surgeon, Cook County and Michael Reese Hospitals, Chicago. Cloth. Price, $9.00. Pp. 620, with 303 illustrations. Philadelphia: Lea & Febiger, 1940.

Dr. Morris Fishbein in the foreword of this volume calls attention to the fact that our feet are among the most vulnerable portions of our bodies. During the World War of 1914-18 it was estimated that from 30 to 40 per cent of all men examined had potential or actual disabilities resulting from flat feet or weak feet.

This volume presents in natural sequence in clear language and with many excellent illustrations the underlying principles of the etiology, pathology, diagnosis and treatment of congenital, static, infectious and paralytic lesions of the foot and ankle. Special consideration is given to fractures, dislocations and other injuries. There is an excellent chapter on the circulatory disturbances of the lower extremities.

This book can be recommended to the medical student, the general practitioner, the industrial surgeon, the military surgeon and the younger orthopedic surgeon as a guide in the diagnosis and treatment of foot and ankle diseases, disabilities, injuries and deformities.

CONVALESCENT CARE. Proceedings of the Conference Held Under the Auspices of the Committee on Public Health Relations of the New York Academy of Medicine, November 9 and 10, 1939. Boards. Pp. 261. New York, 1940.

Convalescence is the more or less gradual return towards normal after a period of physical or mental disability. New York City has devoted more attention to convalescent care than any other city. The first conference on this subject was held by the New York Academy of Medicine in 1925.

At the present conference there were twenty-six papers on all phases of this subject which were listed under four main headings: basic considerations of convalescent care; convalescent care for various types of patients; psychosomatic aspects of convalescent care and the social, financial and administrative aspects of convalescent care.

It should be of great interest to physical therapists that the value of physical therapy frequently is stressed. It is stated that the convalescent home should offer the orthopedic patient a healthful environment with good medical service and equipment including physical therapy. In considering the care of the most convalescent neurologic disorders it is stated that of all therapeutic measures hydrotherapy, massage and exercise are the most necessary. Doctor Bluestone, the director of Montefiore Hospital for Chronic Diseases, believes that certain special departments must be emphasized in any case. These are the departments of nutrition, occupational therapy, physical therapy, recreational therapy, rehabilitation therapy and psychotherapy.

This volume should be read by all physical therapists who are interested in convalescent care.

THE MEDICAL CLINICS OF NORTH AMERICA. PHILADELPHIA NUMBER, VOLUME 24, NUMBER 6, NOVEMBER 1940. With a Three Year Cumulative Index. (Sold only by a year of six consecutive bimonthly numbers.) Cloth, per year $16.00; paper, $12.00. Pp. 324. Philadelphia: W. B. Saunders Company, 1940.

This number of the Medical Clinics is of great interest to physical therapists as it contains an excellent symposium on arthritis. There are clinics on the introduction to the problem of rheumatoid disease; classification, etiology and diagnosis by Drs. Ralph Pemberton and C. Wesler Scull; the roentgen aspects of chronic arthritis by Dr. Edgar W. Spackman; the physiology of joint tissue by Dr. Morris A. Bowie; the blood in arthritis by Drs. G. E. Farrar, Jr., and F. W. Rayburn; fibrositis by Dr. Clyde H. Kelchner; metabolic and dietetic considerations in the treatment of arthritis by Dr. C. Wesler Scull; focal infection and arthritis by Dr. Theodore F. Bach; physical therapy in the treatment of arthritis by Dr. Albert A. Martucci; present status of endocrine therapy in arthritis by Dr. Charles W. Dunn; gall bladder infections as a factor in arthritis by Drs. John H. Willard and Rendall R. Strawbridge; the treatment of chronic arthritis with microdosage of bacterial products by Dr. James C. Small; special therapeutic agents in arthritis by Dr. William I. Westcott; prevention and correction of deformities in arthritis by Dr. Ben T. Bell; reconstructive surgery in chronic rheumatoid arthritis by Drs. Damon B. Pfeiffer and Theodore F. Bach; the diagnosis and treatment of low back pain by Dr. Ben T. Bell, and the integration and coordination of therapy in the care of arthritis by Dr. Ralph Pemberton.

It can be seen from the above list of subjects

that this volume contains the latest thoughts on chronic arthritis. Each subject is considered by an authority in its field. This volume can be recommended to physical therapists treating chronic arthritics.

THE 1940 YEAR BOOK OF PHYSICAL THERAPY. Edited by Richard Kovacs, M.D., Professor and Director of Physical Therapy, New York Polyclinic Medical School and Hospital; Attending Physical Therapist, Manhattan State, Harlem Valley State and West Side Hospitals; Visiting Physical Therapist, New York City Department of Correction Hospital; Consulting Physical Therapist, New York Infirmary for Women and Children, Mary Immaculate Hospital, Jamaica, N. Y., Hackensack Hospital, Hackensack, N. J. Cloth. Price, $2.50. Pp. 464, with 149 illustrations. Chicago: Year Book Publishers, Inc., 1940.

This is the 40th Anniversary Edition of the Year Book Series. The Anniversary Preface gives an interesting history of the series and an excellent picture of the editor of the "Year Book of Physical Therapy," Doctor Kovacs, who has prepared an excellent special article on physical therapy in chronic arthritis.

This year book presents a practical, timely and comprehensive review of 283 articles which the editor considers the best that have appeared in medical literature since the last volume of this title was published. The 149 illustrations are excellently selected.

In part one the literature on the following physical therapy methods is reviewed: thermotherapy, electrotherapy, ultra-sound waves, light therapy, hydrotherapy, balneo- and climatotherapy, mechanotherapy, physical education, occupational therapy and institutional work. Part two is devoted to applied physical therapy in war injuries; cardiovascular, respiratory, abdominal and miscellaneous medical conditions; in arthritis and rheumatoid conditions; in traumatic and orthopedic conditions; in paralysis, in neurologic, mental, pediatric, gynecologic and genito-urinary conditions; in syphilis and gonorrhea; in proctologic, dermatologic, ophthalmologic and ear, nose and throat conditions. This volume should be in the library of every physician and technician using physical therapy.

The chapters are short but well to the point and serve as a practical guide to the deafened. The author points out the helpful, constructive measures and devices available to these people and warns against the fraudulent and harmful. It is a good book to recommend to the hard-of-hearing individual.

SCIENTIFIC INTESTINAL IRRIGATION AND ADJUVANT THERAPY. By Joseph E. G. Waddington, M. D., C. M. (Bennett), Life Member, American Congress of Physical Therapy; Honorary Member, National Society of Physical Therapy; Michigan Society of Massage and Physio-Therapy; Director and Professor of Physical Therapy, Great Lakes College, Ferndale, Michigan. With a foreword by W. Kerr Russell, M. D., B. S., Physician-in-Charge, Physiotherapy Department, National Temperance Hospital, London. Cloth. Price, $5.00. Pp. 310, with 35 illustrations. Chicago: The Bryan Publishers, 1940.

The author states that for many years he has used intestinal irrigation as an aid to the treatment of constipation and intestinal stasis. He presents many arguments as to the benefits of colonic irrigations.

It is believed that the Council on Physical Therapy of the American Medical Association has given a fair statement on this subject when it states: "Elaborate apparatus is not necessary for the administration of colonic irrigations. Colonic irrigations have been greatly exploited by charlatans, ignorant lay persons and, most unfortunately of all, by men within the medical profession. The oft-repeated or routine administration of colonic irrigation is to be strongly deprecated.

"Whereas an occasional series of colonic irrigations may be indicated for the treatment of unfavorable conditions within the intestinal canal, as for example at times in arthritis, or for the removal of retained fecal material from the colon, such indications are relatively infrequent."

COMPLETE GUIDE FOR THE DEAFENED. By A. F. Niemoeller, A.B., M.A., M.S. With a foreword by Harold Hays, M.D., F.A.C.S. Cloth. Price, $3.00. Pp. 256, with one illustration. New York: Harvest House, 1940.

The author gives various estimates which place the number of people with impaired hearing in the United States at ten to twenty million. It often is believed that fifty per cent of adults over thirty-five years of age have undergone an appreciable loss of hearing. It is to these men and women that the author has directed this volume.

The book devotes considerable attention to the problem of personal adjustment, especially to the psychological factor. The author believes that with devices and legislation designed to aid the deafened on the increase, it is becoming easier for the hard-of-hearing to make the necessary personal adjustment.

PRACTICAL CLINICAL PSYCHIATRY. By Edward A. Strecker, Sc. D., M. D., Professor of Psychiatry and Chairman of the Department of Psychiatry, School of Medicine, University of Pennsylvania; Chief of Service and Consultant, Institute of the Pennsylvania Hospital; and Franklin G. Ebaugh, A. B., M. D., Professor of Psychiatry, University of Colorado Medical School; Director, Colorado Psychopathic Hospital. Fifth Edition. Cloth. Price, $5.00. *Pp.* 728, *with 57 illustrations. Philadelphia: The Blakiston Company,* 1940.

The importance of psychiatry in general medicine is receiving more and more recognition. In the curriculum of the medical student, courses dealing with the psychological aspects of the disease as well as the special study of nervous and mental disorders are receiving more prominence.

This book contains excellent chapters on methods of psychiatric examination, psychobiological conceptions of mental disorders and a special chapter on the psychopathological problems of childhood by Kanner. Other chapters dealing with organic reaction types and so-called psychologic mental disorders cover the subject quite thoroughly in practical, straightforward terminology. Well-selected case studies illustrate the various psychoses and abnormal reactions commonly observed in general practice.

Although there are many textbooks on the subject of psychiatry, most of them present definite weaknesses in one or another aspect of this difficult subject. The reviewer feels that Strecker and Ebaugh's "Practical Clinical Psychiatry" suffers the least in this respect and can be recommended most heartily as a reference for students and physicians.

HANDBOOK OF HEARING AIDS. By A. F. Niemoeller, A. B., M.A., B. S. Cloth. Price, $3.00. *Pp.* 156. *New York: Harvest House,* 1940.

This is a volume written for those persons whose hearing is defective to the point of handicap. Hearing aids offered on the market today present a bewildering array of external variations. The author tells the story about hearing instruments, and this book should be read by those hard-of-hearing people about to choose a hearing aid.

The author emphasizes that the hard-of-hearing must solve their problem through three measures: medical aid, hearing aids and lip reading. He gives a solemn warning not to allow the value of lip reading to become minimized so as to be wholly dependent upon the hearing aid.

GROWING OUT OF BABYHOOD: PROBLEMS OF THE PRESCHOOL CHILD. By William S. Sadler, M.D., F.A.P.A., Chief Psychiatrist and Director, the Chicago Institute of Research and Diagnosis, Chicago, and Lena K. Sadler, M.D., F.A.C.S., Associate Director, the Chicago Institute of Research and Diagnosis. Cloth. Price, $2.50. *Pp.* 350. *New York & London: Funk & Wagnalls Company,* 1940.

Psychologists are agreed that getting the proper or improper start in life has much to do with the eventual success or failure of the individual when he becomes an adult. Only those who deal with babies appreciate the utter dependence of these "little animals" upon those who constitute their environment. Although there are certain developments which apparently are instinctive or spontaneous, much of the infant's behavior is determined by what he learns from his parents. Feeding, sleeping, bowel and bladder training, and play activities should offer no serious problems if handled properly; whereas bed wetting, thumb sucking, temper tantrums, bad sex habits and so forth, often cause much anxiety. The authors discuss each of these subjects in great detail and as a result have formulated a sizable volume on the normal and abnormal reactions of the infant. Much excellent information is available but unfortunately the authors repeat and elaborate at too great length. Such "padding" tends to make the reading cumbersome.

HANDBOOK ON TUBERCULOSIS FOR PUBLIC HEALTH NURSES. By Violet H. Hodgson, R. N., Supervisor, Outpatient Tuberculosis Nursing in the New York State Department of Health. Paper. Price, 50c. *Pp.* 92. *New York: National Tuberculosis Association,* 1939.

This handbook will assist the public health nurse to appreciate the significance of tuberculosis as a family and community problem. Information about the nature of the disease is clearly set forth in order that nurses may be alert to their opportunities for early case finding as a part of their routine nursing services in the home, school, industry, hospital and clinic. The family is considered as a unit for general health services including the application of control measures. The contribution which the nurse can make in teaching the patient and family how to carry out the physician's recommendations for treatment and helping them to plan for and adjust to treatment is emphasized throughout. The subject matter is extremely practical in its approach, concisely organized and clearly presented. It should be familiar to every nurse and will be useful also to any worker who is engaged in health services.

MANAGEMENT OF THE CARDIAC PATIENT. By William G. Leaman, Jr., M.D., F.A.C.P., Assistant Professor of Medicine in Charge of the Department of Cardiology, Woman's Medical College of Pennsylvania, Philadelphia; Cardiologist, Woman's College Memorial, Northeastern Hospitals, and Philadelphia Hospital for Contagious Diseases; Consulting Cardiologist, St. Luke's and Children's Hospitals, Philadelphia; Assisting Visiting Physician, Philadelphia General Hospital; Chairman, Committee on Diseases of the Heart and Circulation, Philadelphia County Medical Association. Cloth. Price, $6.50. Pp. 705, with 255 illustrations. Philadelphia: J. B. Lippincott Company, 1940.

By outlining the diagnosis and treatment of a large number of cases this volume on the management of the cardiac patient offers to the general practitioner an example of practically every cardiovascular problem which he may meet in his practice. There are chapters on approach to therapy, heart failure, rheumatic heart disease, pericarditis, acute and subacute bacterial endocarditis, syphilitic cardiovascular disease, angina pectoris, coronary disease, including thrombosis, hypertensive cardiovascular disease, congenital heart disease, the heart in thyroid disease, cardiac arrhythmias, functional heart disease, the heart in pregnancy, allergy and the heart, cardiac problems in surgical practice, cardiac emergencies, diet in heart disease, the senile heart and an introduction to the study of electrocardiography.

The excellent chapters on physical therapy in the treatment of heart disease and the prescription of exercise make this volume of value as a reference work for those physical therapists treating cardiac cases in spas or general hospitals. As the majority of the cardiac cases in our country are treated at home, this book is specially valuable to the general practitioner because the methods most useful in home treatment are presented in detail.

ORTHOPEDIC SURGERY FOR NURSES, INCLUDING NURSING CARE. By Philip Lewin, M.D., F.A.C.S., Associate Professor of Bone and Joint Surgery, Northwestern University Medical School; Attending Orthopedic Surgeon, Cook County and Michael Reese Hospitals; Lecturer to Nurses of Cook County School of Nursing and Michael Reese Hospital, Chicago. Third Edition, revised and reset. Cloth. Price, $3.50. Pp. 433, with 457 illustrations. Philadelphia: W. B. Saunders Company, 1940.

With the exception of about 60 of the 433 pages, the material and information in this book are of interest and value to all physical therapy technicians. It is especially valuable as a reference book, for in it are discussed briefly, or mentioned, the chief diseases and conditions which are presented to the orthopedic surgeon. The purpose of the book is to give nurses a somewhat panoramic view of orthopedic problems, but physical therapy technicians will find it equally helpful, and it is a good book to keep within easy reach. Since the discussions are not lengthy and are to the point, the technician may find and review the topic in question is a very short time.

The major part of the book deals with the various diseases and crippling conditions, and the discussions concern symptoms, pathology, etiology, treatment, prognosis. There are helpful suggestions for the physical therapy technician, especially in the chapters on posture, poliomyelitis, scoliosis, arthritis and first aid care in fractures.

In the last 67 pages, orthopedic problems are classified according to joints or other parts involved.

There are 457 excellent illustrations which add appreciably to the value of the book. There are a number of charts and outlines, such as a muscle chart, a terminology of orthopedic conditions, causes of bone and structure conditions.

This book can be recommended to physical therapy technicians.

YOUR CHILD'S DEVELOPMENT AND GUIDANCE TOLD IN PICTURES. By Lois Hayden Meek, Ph.D. Cloth. Price, $2.00. Pp. 166, with 163 illustrations by Lucia Manley. Philadelphia, New York, Toronto & London: J. B. Lippincott Company, 1940.

The physical and mental development of the child frequently has been studied by psychologists, physicians, sociologists and other research workers. The results of these studies usually are collected in monograph form with numerous elaborate charts and page after page of statistics. It is a rare parent who could understand and profit by a perusal of this type of literature. The author of "Your Child's Development and Guidance Told in Pictures" no doubt has realized this. She has prepared a book for parents, to help them understand better the development of their young children. Using simple language and a multitude of photographs and drawings she has presented common sense information regarding the child's physical development, habits of eating and elimination, play, et cetera. This is the type of information which all parents will welcome. By utilizing this knowledge they are more liable to render the type of wholesome guidance which every child needs.

THE INJURED BACK AND ITS TREATMENT. Edited by John D. Ellis, M.D. Cloth. Price, $5.50. Pp. 377, with 156 illustrations. Springfield, Ill.: Charles C. Thomas, 1940.

Realizing that the management of back injuries is not yet in a textbook stage of standardization the editor has presented a series of papers written independently by various authors, representing sometimes divergent viewpoints. The editor has done this because he believes that the contradictions and differences of opinion thus elicited is more stimulating and instructive than a didactic presentation of the same material.

Doctor Ellis has made an excellent choice of contributing authors. There are chapters on "Man's Posture" by Prof. Sir Arthur Keith; "Backache: A Symptom of Visceral Disease" by Nathan Davis III, "The Management of Recent Compressed Fractures of the Vertebral Bodies Without Cord Injury" by H. Earle Conwell; "Neurological Aspects of Injuries to the Back" by Loyal Davis and Hale A. Haven; "The Role of the Articular Facets in Low Back Pain" by Ralph K. Ghormley; and "Faulty Body Mechanics and Back Injuries" by Robert B. Osgood. Doctor Ellis has written three interesting chapters on the routine examination of the injured back, relation of trauma to certain inflammatory degenerative diseases and anomalies of the spine, and the treatment of minor injuries.

Physical therapists in general hospitals have always one or more injured or painful back cases to treat. This book can be recommended to them as an authoritative reference work. Industrial surgeons are called to treat many serious and minor back injuries. In many of these minor injuries the disability is prolonged out of all proportion to what one would expect from the nature of the injury sustained. This book will prove particularly valuable to the industrial surgeon because of its suggestions on the examination, diagnosis and treatment of these so-called "minor" injuries of the back.

TABER'S CYCLOPEDIC MEDICAL DICTIONARY INCLUDING A DIGEST OF MEDICAL SUBJECTS: MEDICINE, SURGERY, NURSING, DIETETICS, PHYSICAL THERAPY. By Clarence Wilbur Taber and 14 *Associates. Cloth. Thumb-indexed,* $3.00; *plain,* $2.50. *Pp.* 1488, *with* 273 *illustrations. Philadelphia: F. A. Davis Company,* 1940.

This is a medical dictionary including between 50,000 and 60,000 words. The definitions are cyclopedic in character with many excellent illustrations. It is authoritative because the editor has fourteen associate editors who are specialists in their various fields.

This work is not only a medical dictionary but it is a source book of condensed medical information which will make unnecessary the consultation of other works. It is highly recommended.

PENNY MARSH, SUPERVISOR OF PUBLIC HEALTH NURSES. By Dorothy Deming, R.N. Cloth. Price, $2.00. *Pp.* 303, *with* 9 *illustrations by Dorothea Warren. New York: Dodd, Mead & Company,* 1939.

This career book, which is a sequel to "Penny Marsh, Public Health Nurse," gives a vivid picture of the experiences of Penny Marsh on the staff of a large public health nursing agency in a big city. The author, who is general director of the National Organization of Public Health Nursing, has told an interesting story full of action and human interest and also has interwoven a great deal of authentic information about public health nursing. The book will appeal particularly to prospective nursing students, student nurses and young graduates who may be attracted to public health nursing as a profession. For vocational purposes it will be a useful addition to the libraries of high schools and nursing schools.

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